FEBRUARY 9, 1953

Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION

AIEE Report . . . Starts on Page 85

UTILITIES—Tackle generator load control, and flyash precipitation; propose wood structures for 330-kv transmission.

INDUSTRIALS—Adopt grounded distribution systems, consider 240/416-v combined light and power.

MANUFACTURERS—Improve switchgear and relaying, offer white mercury lamp.

Elgin B. Robertson . . .

. . . Nominee for the presidency of the American Institute of Electrical Engineers, has been a director of the institute since 1947.

TV Pictures Combustion Inside Furnaces

Operator watches burning fuel on TV screen . . . . . Page 92

Selling Creates the Lighting Market

In ten years energy used for lighting can be doubled . . Page 102

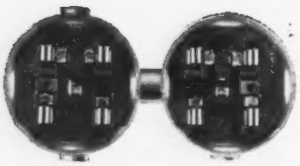
Mortar Lining Extends Pipeline Life

Corroded steel penstocks are now as good as new . . . . . Page 106

Shooting Industrial Plant Troubles

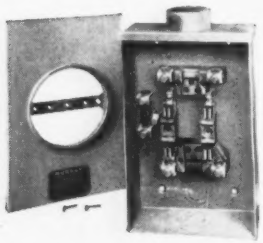
DuPont kills the "bugs" at Sabine River Works . . . . . Page 134

SIMPLIFY your meter mounting problems....choose from the COMPLETE Murray line



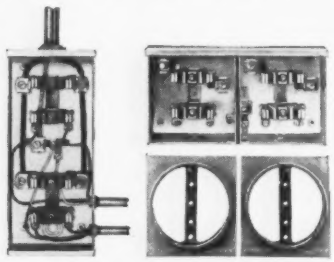
OUTDOOR METER SOCKET

Single or multiple units (saves nippling in the field). Provisions for fifth and sixth jaws. Reversible jaws for vertical or horizontal mounting. Two or three hubs—1" or 1¼". Pressure connectors. Finished in grey baked-on Melamine (a really rugged finish).



OUTDOOR WEATHERPROOF—RAINTIGHT METER SOCKETS

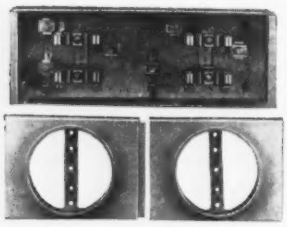
A medium duty socket. Contact surfaces of jaws are silver plated. Single phase installation can be converted to polyphase by substituting polyphase blocks. Sturdy cabinet, built of corrosion resistant steel. The finish is baked-on Melamine. Deep lipped top with hub for 2" conduit, is welded to sides and back. Cover slides under top, over sides and bottom, making device completely raintight. An economical unit.



OUTDOOR SOCKET METER TROUGHS

(Vertical or Horizontal)—

Single or multiple units. On multiple units, line and load terminals at each meter position are lay-in pressure type connectors, which simplify bussing. Line connectors for #4 to #3/0 cables. Load connectors for #4 to #1/0 cables. Made in sizes to accommodate from one to six meters.



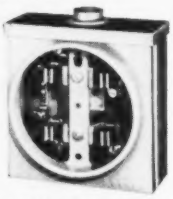
INDOOR SOCKET METER TROUGH

(Horizontal)—

Available in one to three meter positions. Can be ganged readily. Line and load terminals are pressure type. Line connectors for #4 to #3/0 cables, load connectors for #4 to #1/0 cables. Lay-in connectors simplify wiring.

TYPE H.D. HEAVY DUTY METER MOUNTING DEVICE

Has a maximum continuous carrying capacity up to 200 Amperes. Can be used with any standard 4 or 5 terminal meter on 1, 2 or 3 phase, 3 wire installations. Where the standard 50 Ampere meter is used, the heavy duty mounting is suitable for 200 Amperes intermittent duty and 150 Amperes continuous duty. Vise-jaw terminals for high-strength, high conductivity. Pressure connectors take line conductor sizes from #6 to #4/0. Equipped with transparent acetate shield for safety in installation and testing. By-pass clamps permit removal or testing of meter without interrupting load. Corrosion resistant, weatherproof case. Supplied with 2" or 2½" hubs.



MODIFIED OUTDOOR SOCKET METER TROUGH

An economical device for those whose requirements call for a compact, single position unit. Plenty of wiring room. All connectors are pressure type and take up to #1 wire. 1" or 1¼" hubs available. Melamine finish.

COMBINATION METER SOCKET AND SERVICE CONTROL EQUIPMENT

Murray meter sockets are available in combination with service control equipment. Factory assembly assures a rock-solid, perfectly aligned unit. Service control equipment includes Murray Fully Magnetic Circuit Breakers. Murray Magnetic Breakers always carry the full load, are never affected by ambient temperatures. The sun's rays, for instance, will never cause Murray Breakers to trip. Both socket and service control equipment are finished in baked-on grey Melamine.

Murray can fill all your needs for socket type meter mounting equipment. You can choose any device you need—from the round socket to heavy duty equipment. Ordering and stocking or specifying are simplified when you buy from one source.

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2. Outdoor Weatherproof—Raintight Socket ☐
3. Heavy Duty Meter Mounting Device ☐
4. Outdoor Socket Meter Troughs
   - Vertical ☐
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5. Modified Outdoor Socket Meter Trough ☐
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7. Combination Meter Socket and Service Control Equipment ☐

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Man on the Cover

Elgin Barnett Robertson, who has been nominated for the presidency of the American Institute of Electrical Engineers, was born at Meridian, Texas, on June 4, 1893. At 22 he received his electrical engineering degree from the University of Texas and started North. Until 1920 he stayed with Westinghouse Electric Corp. Then he became chief electrical engineer for the Railway & Industrial Engineering Co, Greensburg, Pa.

He remained there until 1924 when he thought it was time to try his luck elsewhere. In 1928 he formed his own company at Dallas, Texas, a company of which he is still the president. In 1939 he also became president of the Plastics Manufacturing Co. During the war he served with the regional War Production Board.

President to Be . . . If tradition is followed, Robertson will be the next AIEE president. Spokesmen for the institute will avow with religious fervor that his election cannot be taken for granted until the last ballot is in from all members of the institute who care to vote. But there doesn't seem to be a single institute member around who can remember the last time a nominee was defeated. So far there is no indication that this present presidential election will not follow the usual pattern.

He's a Texan . . . Next June at the Summer General Meeting at Atlantic City Robertson will be presented as the 65th president of the institute, although he will not take office until Aug. 1. It is likely that he will be the first native Texan to wield the gavel. Texas has never been noted for its electrical engineers.

But in his new position this Texan will have the satisfaction of being one of a long line of distinguished electrical engineers. A man can't help but be a bit proud to be a successor to such outstanding electrical engineers as Edward Weston, Elihu Thomson, Alexander Graham Bell, Charles P. Steinmetz, and M. I. Pupin. And a man can't help but be a bit proud to be the president of such a large and outstanding an association of engineers as the AIEE.

Electrical World

Published for 79 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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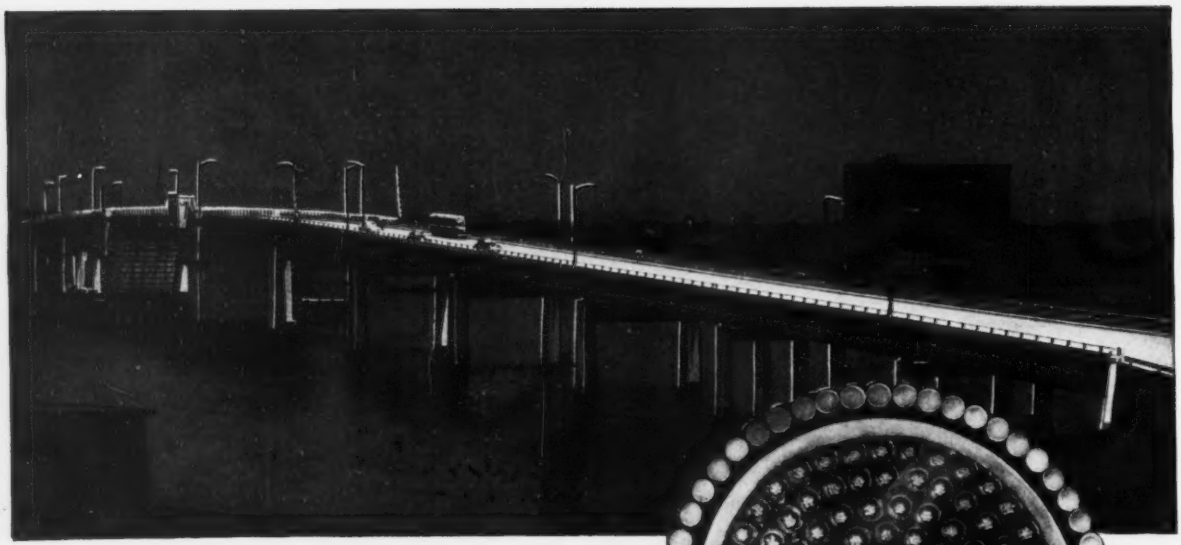
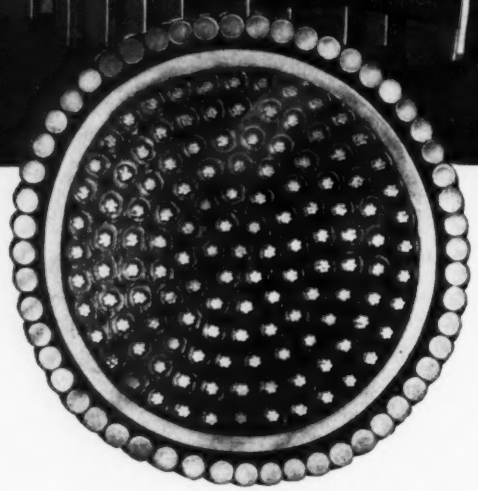


new ELIZABETH RIVER BRIDGE* features unusual OKONITE cable designs



Nearly 5 inches in diameter, this 127-conductor Okolite-Okoprene multi-purpose submarine cable contains circuits for power, control, lighting and signaling.

Just about everything but the traffic is energized through Okonite cables on the new Elizabeth River Bridge between Norfolk and Berkley, Virginia. Operating drives, brake motors, gates, pumps, lights and even electric heating units are equipped with cables designed by Okonite engineers in cooperation with J. E. Greiner Co., Consulting Engineers.

A multi-purpose submarine cable, trenched in below the river bed between the bascule piers, contains circuits for power, control, lighting and signals. This 127-conductor Okolite-Okoprene cable has a lead sheath of record diameter (4.1") and, in addition, has the further protection of a layer of jute and heavy steel armor wires.

Another unusual design is the 3-conductor Okolite-Okoprene cable for the navigation lights. This has a flexible bronze basket-weave armor to permit it to move with the fender piling and also protect it against continual salt spray.

These and other cables on this job illustrate how Okonite cables are engineered to meet the most unusual job requirements. When ordering cables for any application ask your Okonite representative to help you choose the one that is best suited for your needs. The Okonite Company, Passaic, N. J.

* *Consulting Engineers* J. E. Greiner Company, Baltimore, Maryland — *Contractors* Tidewater Construction Corporation, Norfolk, Virginia — *Electrical Subcontractors* Tuck & Kendall, Inc., Norfolk, Virginia

The best cable is your best policy

OKONITE OKONITE SINCE 1878 *insulated wires and cables*

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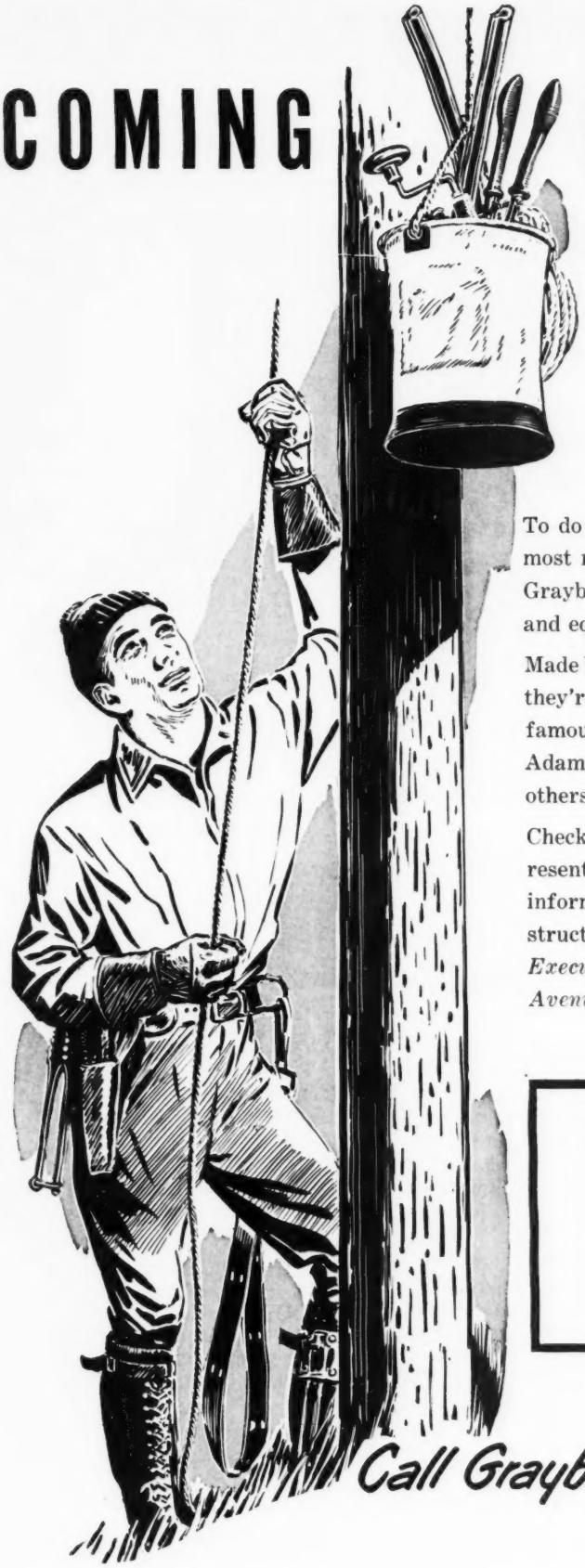

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The next time you need high voltage cables be sure to specify ANHYDREX XX for economy, quality, and satisfaction. ANHYDREX XX Insulated Cables offer the kind of performance that reduces maintenance and replacement costs. For more complete information about what ANHYDREX XX will do for you, contact your nearest Simplex representative or write in care of the address below.

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Sunbury Plant of Pennsylvania Power & Light Co., Sunbury, Pa.

Pennsylvania Power & Light Company's

SUNBURY STATION

world's largest anthracite-fired steam electric plant, is "supported" by

GRINNELL HANGERS

Pennsylvania Power & Light Company at its Sunbury Plant faced the problem of providing flexible, but constant support, to main steam piping carrying superheated steam under a pressure of 1350 pounds per square inch, and at a temperature of 950°F.

For "support" on that tough assignment . . . Pennsylvania Power & Light turned to Grinnell. And that is understandable. Grinnell is America's No. 1 supplier of pipe hangers and supports. Grinnell combines modern manufacturing with expert background knowledge gained during a century of piping specialization. Grinnell, and Grinnell alone, can offer these advantages:

- Complete "start to finish" production facilities — including research, design manufacturing, engineering and field service.
- Practical experience in every type of piping gained during the past 100 years.
- Coast to coast distribution — enabling "out of stock" purchases, anywhere.

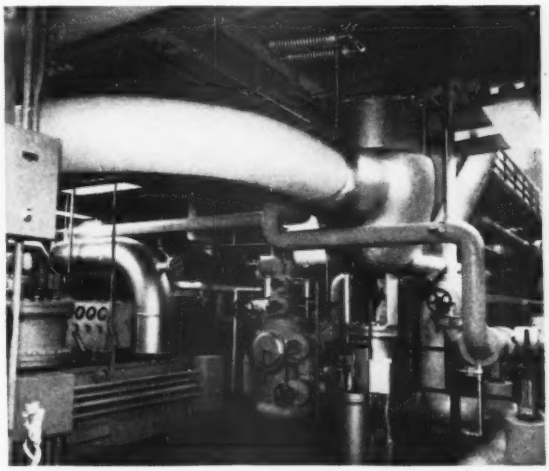
Call on Grinnell . . . "whenever piping is involved."

GRINNELL MODEL L CONSTANT-SUPPORTS maintain full safety factor in high temperature, high pressure systems. 3 physical structures accommodate maximum travel requirements of 2½, 5 and 10 inches; 16 sizes collectively cover numerous load ranges between 141 and 19,530 pounds.

GRINNELL PRE-ENGINEERED SPRING HANGERS — maximum variation in supporting force per ½" of deflection is 10½% of rated capacity — in all sizes. 16 sizes available from stock — load range from 74 pounds to 9000 pounds.

GRINNELL VIBRATION CONTROL AND SWAY BRACES—dampen vibration, oppose pipe sway and absorb shock. 3 sizes give full deflection forces from 200 to 1800 lbs.; have initial precompressed spring forces from 50 to 450 lbs. respectively.

Twin Grinnell Constant Support Hangers provide uniform lift for steam turbine throttle valve to prevent stresses in piping as it moves from "cold" to "hot" positions.



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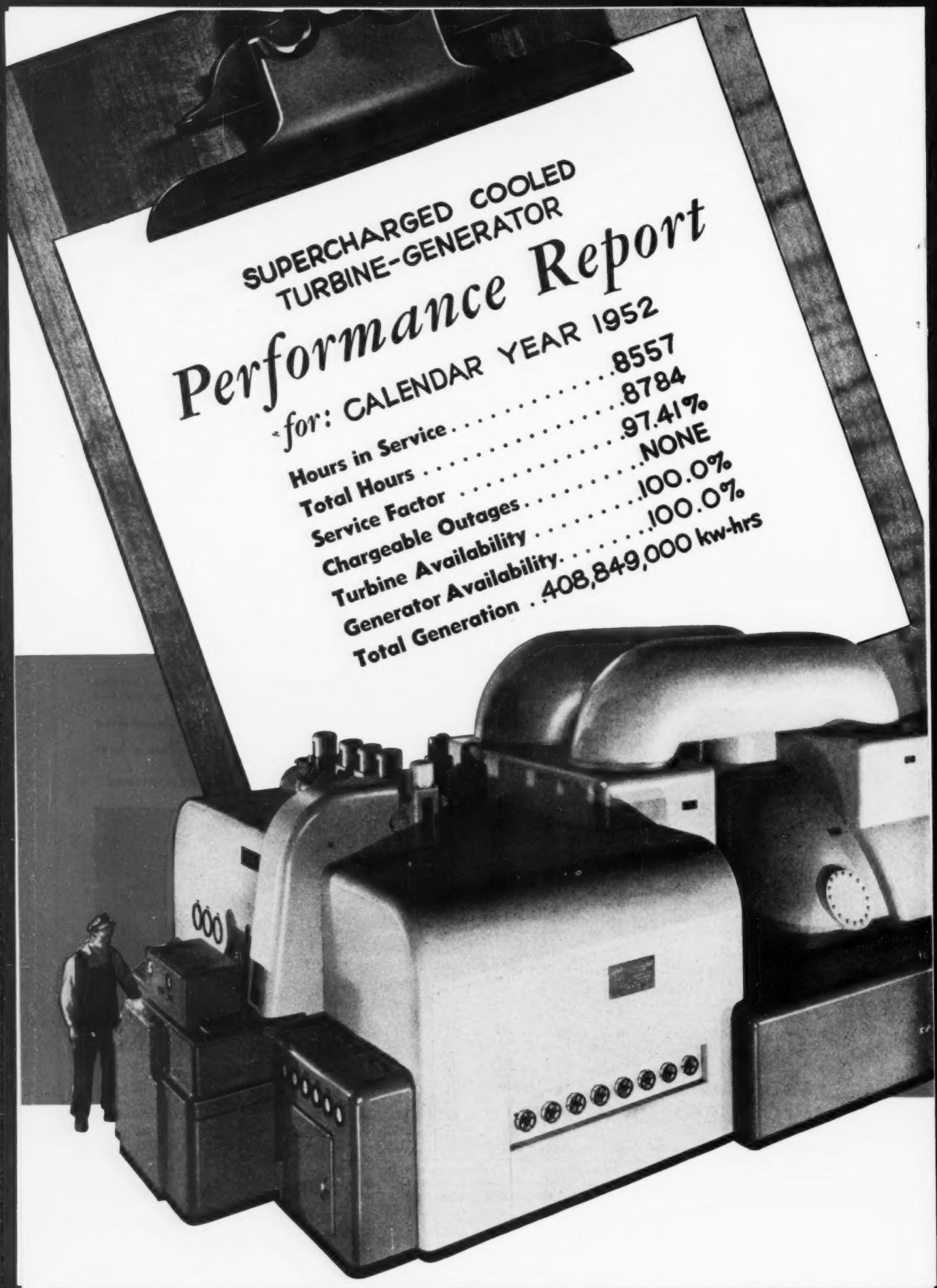

SUPERCHARGED COOLED
TURBINE-GENERATOR
Performance Report
for: CALENDAR YEAR 1952
Hours in Service 8557
Total Hours 8784
Service Factor 97.41%
Chargeable Outages .....NONE
Turbine Availability 100.0%
Generator Availability 100.0%
Total Generation .408,849,000 kw-hrs

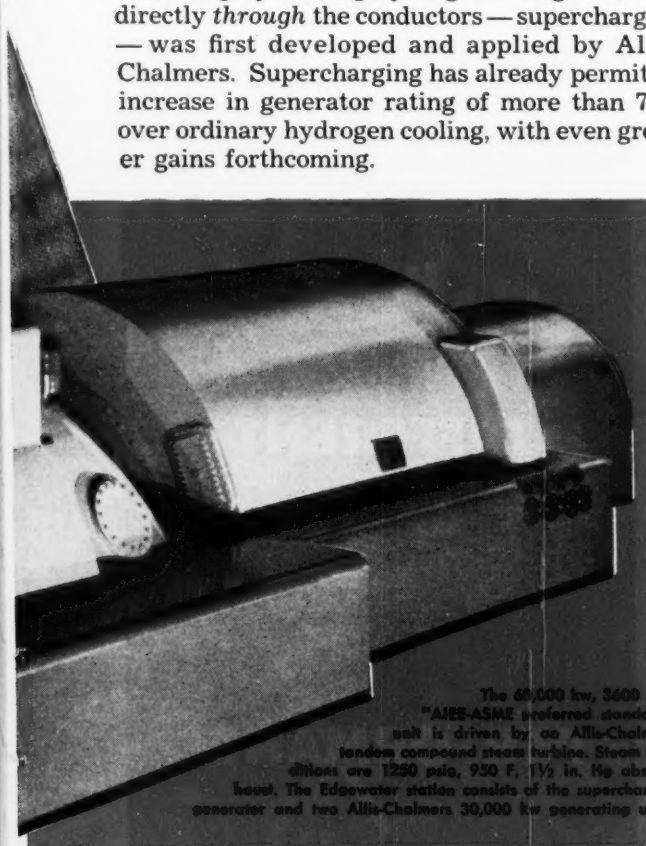
Availability for Duty: 100.0%!

Supercharged Hydrogen Cooling — the greatest advance *ever* made in turbine generator design — has proved itself brilliantly in its first full year's commercial operation!

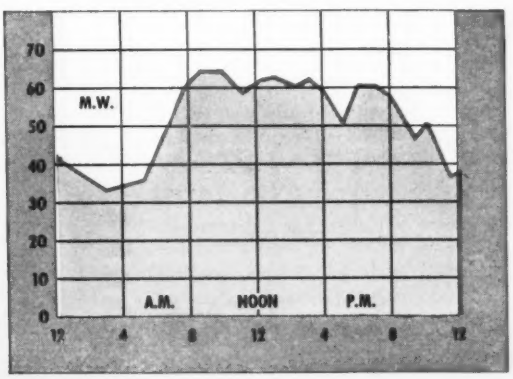
At left is the calendar year 1952 Performance Report on the Allis-Chalmers 60,000 kw steam turbine generator unit at the Edgewater station, Sheboygan, Wisconsin Power and Light Company. Both turbine and generator Availability were 100.0%, with on-the-line Service Factor over the entire year being 97.41%.

Cooling by driving hydrogen at high velocity directly *through* the conductors — supercharging — was first developed and applied by Allis-Chalmers. Supercharging has already permitted increase in generator rating of more than 70% over ordinary hydrogen cooling, with even greater gains forthcoming.

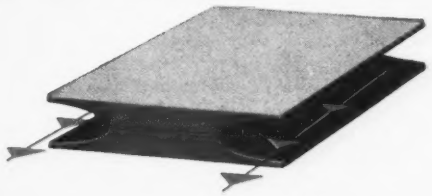
You get the real design advances *first* from Allis-Chalmers, builder of the world's widest range of power plant equipment. When planning a steam-electric power plant, your task will be simpler and results better if you deal with Allis-Chalmers. For complete literature on all products, call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3981



The 60,000 kw, 3600 rpm "AIEE-ASME preferred standard" unit is driven by an Allis-Chalmers tandem compound steam turbine. Steam conditions are 1250 psia, 950 F, 1½ in. Hg abs exhaust. The Edgewater station consists of the supercharged generator and two Allis-Chalmers 30,000 kw generating units.



Typical daily load cycle of the Sheboygan supercharged unit. It experiences wide load fluctuations because it operates in parallel with base load hydro power. Supercharged units are suited for even this strenuous duty because of high part load efficiency and shorter, more thermally stable construction.

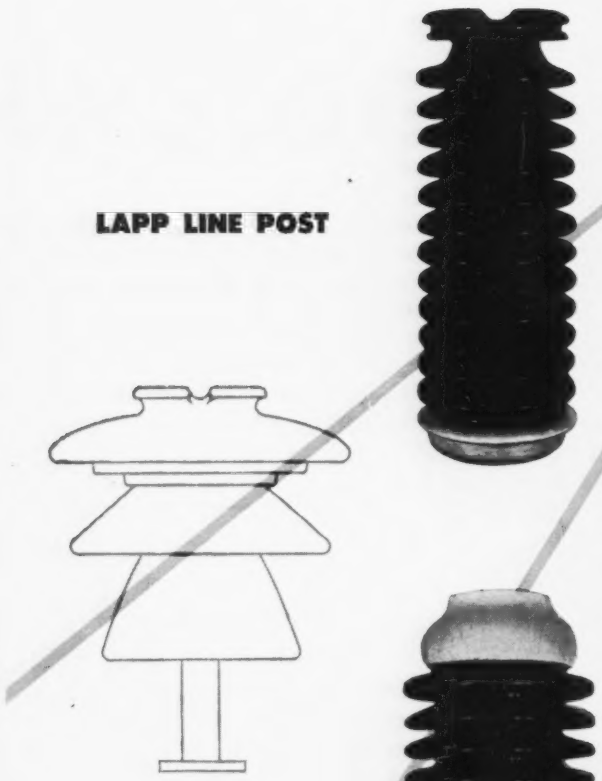


Cross sectional view, showing two turns of typical supercharged conductor construction. The cooling gas is in intimate contact with the copper, removing the heat right where it originates. The heat does *not* have to migrate through insulation and surrounding metal to reach vent ducts in the rotor teeth or body.

ALLIS-CHALMERS

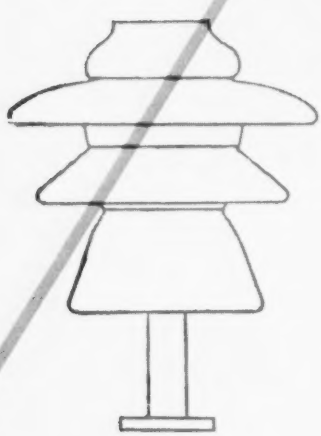
A-C ALLIS-CHALMERS

***FIRST* with Supercharged Hydrogen Cooling!**



LAPP LINE POST

LAPP STATION POST



DIFFERENT IN APPEARANCE

. . . JUST AS DIFFERENT IN PERFORMANCE

You can't help noticing Lapp Line Post and Station Post insulators on lines and stations as you drive along the nation's highways. They look so different from conventional insulators! But the difference is even more spectacular in the maintenance and service record books of the companies operating them. Lapp Posts are strong where Pin-Type insulators are weak. The performance "differences" which can make a dollars-and-cents difference in your operating costs include . .

FLASHOVER

Multiple short sturdy petticoats keep the arc away from body of the insulator, are themselves less affected by rapid heating. If arc is severe enough, one or more petticoats break away, leaving body intact, arcover and leakage distance only slightly reduced.

MECHANICAL ATTACK

Similarly, short, stout petticoats protect against stones or bullets. But they are made to break away before sturdier post body can be damaged. (A smaller diameter target, too!)

CONTAMINATION

For service in contaminated atmosphere, Lapp Post Fog-Type design offers the dual advantage of uniform leakage path with consequent elimination of "hot-spot" shielded arc-starting areas, and "self-cleaning" in action of wind and rain.

PUNCTURE AND CRACKING

External flashover path same as internal puncture path—no puncture. Hardware externally attached, loads porcelain only in compression, eliminates cracking which comes from bursting forces of nested porcelain shells and metal pin.

RADIO INTERFERENCE

No live parts within insulator—terminals separated by full length of the unit. Corona does not form at operating voltages. Radio-free permanently, as a design conception.

PHYSICAL SIZE

Small diameter for easy hot-line work, economical double-arming. Extra height for extra clearance or use of shorter poles.

APPEARANCE

The "differentness" of appearance is itself an asset in public relations, particularly in handling of complaints of radio interference. New, modern, "different" insulators are evidence of company cooperation.

SERVICE RECORD

On hundreds of installations, records show that systems on Lapp Line Post and Station Post insulators have fewer outages, require fewer insulator replacements, less maintenance than systems on other insulators.

Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, NEW YORK

Illustrated here is the 2-station counter.

Your customer is served at ease

Your cashier or bookkeeper works at ease

With the NEW Sectional Customer Service Counter

This new Remington Rand Service Counter has all the advantages you've been looking for. Just check this list and see for yourself:

1. Your customer is waited on in comfort at a counter 50" high. Your cashier or clerk waits on him in comfort seated at a desk 31" high, with everything she needs within easy reach.

2. You save costly floor space with this sectional counter, by combining the usual counter with the desk ordinarily used, enabling the clerk to face the customer.

3. The working side can be fitted with either steel or insulated files or cabinets; the insulated housings give one hour's protection against fire to your valuable records, 24 hours a day.

• • •

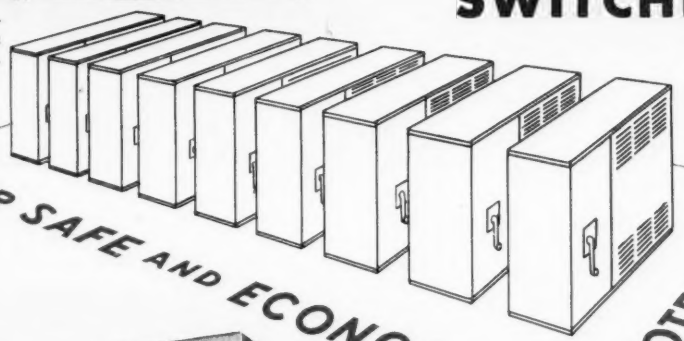
Your clerks will be more comfortable and will do better work; your office will look far more attractive and less cluttered, with this counter planned *for you*. Write today for free booklet SC246. Address Room 1711, 315 Fourth Avenue, New York 10.

Remington Rand INC.

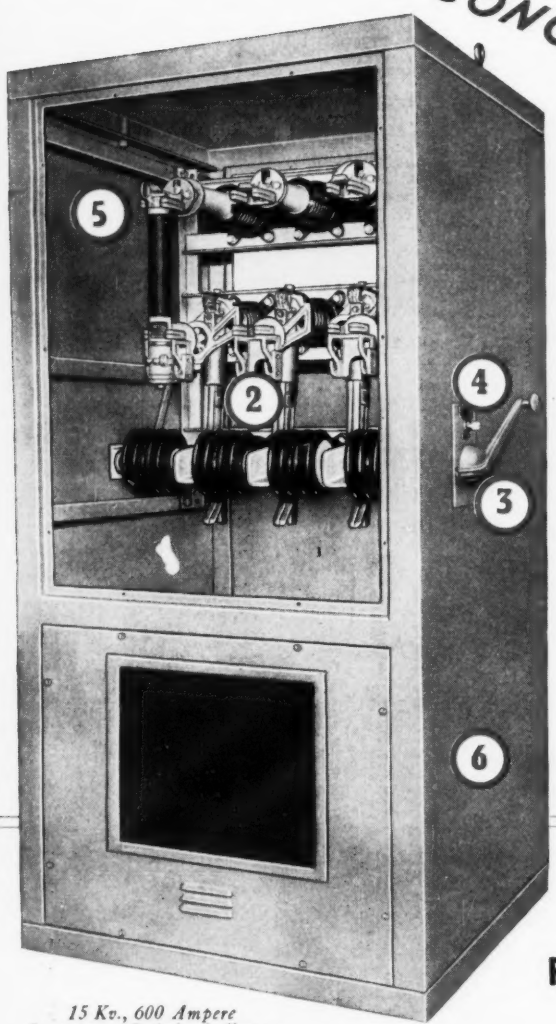
Important Load Centers— *feature*

R&IE INTERRUPTER SWITCHES

Famous — Barr Companys' new Southtown store in outlying St. Louis.



FOR SAFE AND ECONOMICAL PROTECTION



15 Kv., 600 Ampere Interrupter Switch similar to the ones used in above installation. (Only one fuse shown; baffle plates removed)

Check the facts

1. Compact, easy to install, mounts anywhere - wall, transformer throat, etc.
2. Reliable load interrupter and open gap switch assembly, single or double throw.
3. Operating handle equipped with sequencing device to prevent re-opening of switch before it is fully closed. This guarantees proper interrupting operation.
4. Provision for Kirk Key Interlock or Solenoid type system.
5. Any fuse combination - above interrupter as shown, or below, if required.
6. Furnished with or without housing. Key or mechanical door interlocks optional.

R&IE EQUIPMENT DIVISION

I-T-E CIRCUIT BREAKER COMPANY

GREENSBURG, PA.

The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES
INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

Low-cost accuracy; neat and easy to install!

Low installation costs and strict accuracy have been linked together in Westinghouse Instrument Transformers for years. Basic construction features like top-mounted HV bushings simplify connections . . . make neat installations. Here, time and effort are saved by bolting the Current Transformers to the middle cross-arm and the Potential Transformers to the lower. Wiring is practically straight through. In addition, design features, like vacuum plastic impregnation, eliminate maintenance problems. The Midwestern utility using these transformers bought them on the basis of *low initial cost* and *ease of installation.* Its Meter Superintendent reports that metering has been "most accurate."

Westinghouse Instrument Transformers offer you the most complete line in the Industry . . . each type and rating is designed for a specific need in metering or relaying applications. Your Westinghouse representative will help you select the right Instrument Transformer for your problem. Or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70652

YOU CAN BE SURE...IF IT'S
Westinghouse
INSTRUMENT TRANSFORMERS

Power for Atomic Research!

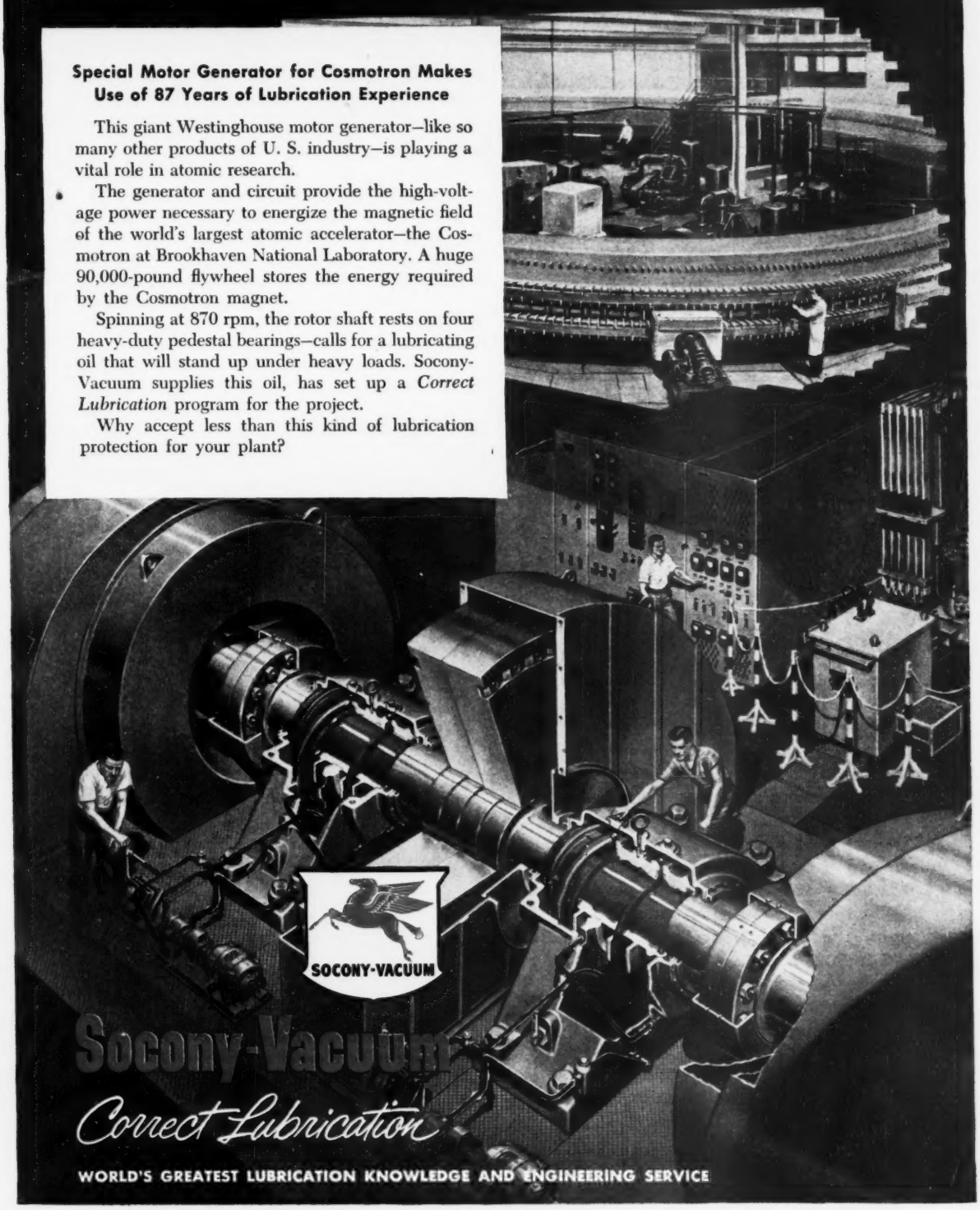
Special Motor Generator for Cosmotron Makes Use of 87 Years of Lubrication Experience

This giant Westinghouse motor generator—like so many other products of U. S. industry—is playing a vital role in atomic research.

The generator and circuit provide the high-voltage power necessary to energize the magnetic field of the world's largest atomic accelerator—the Cosmotron at Brookhaven National Laboratory. A huge 90,000-pound flywheel stores the energy required by the Cosmotron magnet.

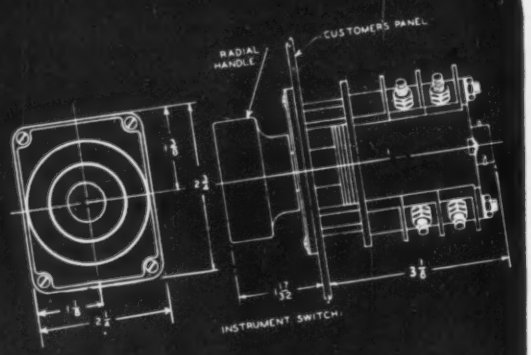
Spinning at 870 rpm, the rotor shaft rests on four heavy-duty pedestal bearings—calls for a lubricating oil that will stand up under heavy loads. Socony-Vacuum supplies this oil, has set up a *Correct Lubrication* program for the project.

Why accept less than this kind of lubrication protection for your plant?



SOCONY-VACUUM OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

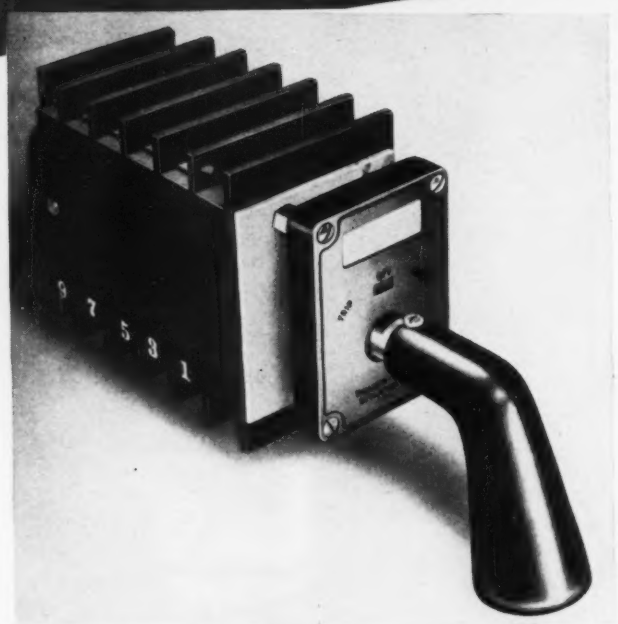
Where Panel Space is at a PREMIUM . . .



use the R-4 Miniature Rotary Switch

Illustrated above is the R-4 Miniature Rotary Switch—available now for those applications where space is at a premium. Featuring unit construction, silver contacts, 600 volt insulation, enclosed mechanism and choice of handles, the R-4 provides the same high interrupting capacity, long life and flexibility found in the standard R-2 Control switch illustrated at right.

Both R-2 and R-4 Rotary switches are available in a wide combination of contact arrangements for Instrument—Control—Transfer—Auxiliary and Special Applications.



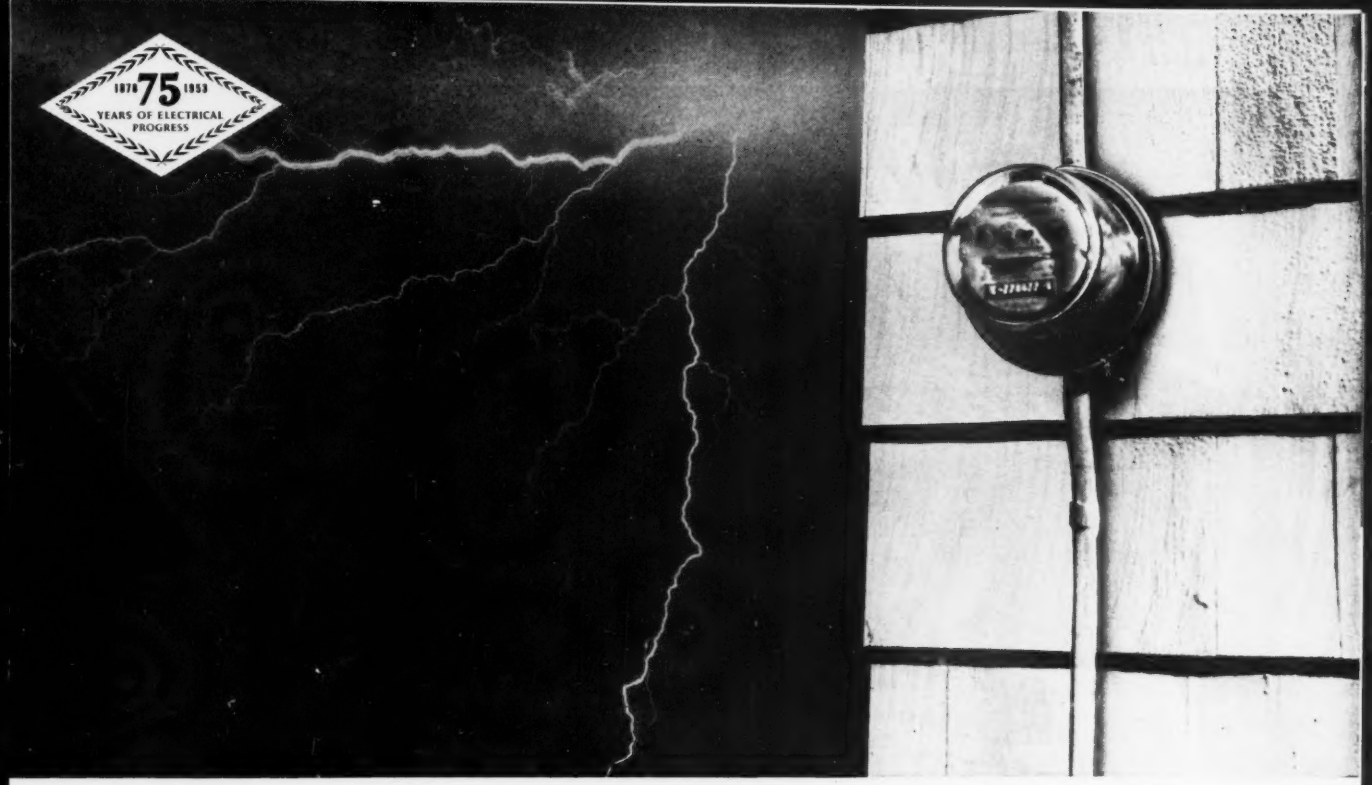
Catalog 7140 contains complete information. Request your copy today. For a prompt answer to your switch problem—consult the Factory or your nearest Roller-Smith Sales office.

ROLLER SMITH

ROLLER-SMITH CORPORATION

BETHLEHEM, PENNSYLVANIA

1876 75 1953 YEARS OF ELECTRICAL PROGRESS



Even in cases of severe lightning surges, results show that you will . . .

Reduce Lightning Losses, Save Repair Costs With G-E Certified I-50 Watthour Meters

Service experience in severe lightning areas has shown that General Electric I-50 watthour meters have an unusual record of maintenance-free operation. This results from several significant design achievements embodied in the I-50.

The I-50 potential coil is molded of polyethylene insulation and the current coil is butyl-molded. The result: long life and high impulse strength.

RETARDING MAGNETS are of high-coercive alnico V encased in and shielded by the die-cast aluminum frame. This shielding provides additional protection against decalibration resulting from lightning surges.

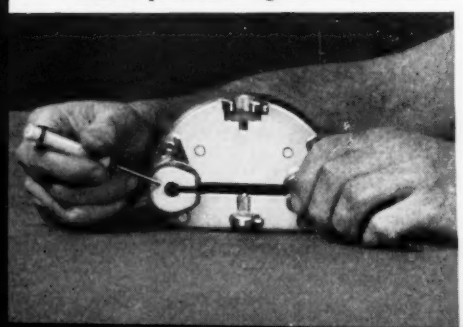
Relief gaps, co-ordinated with coil insulation, protect the meter by confining any spark-over to a point of minimum possible damage.

THE RESULT of this careful I-50 design has been an unusual freedom from operational failures, physical damage, or decalibration in service. This means savings to utilities in repair and maintenance costs.

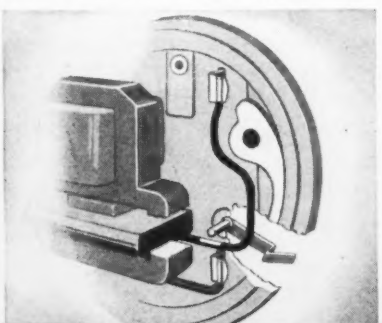
For more information about the G-E certified I-50 watthour meter, ask for a showing of our new motion picture, "Accent on Accuracy." Call your nearest G-E representative or write General Electric Company, Schenectady 5, New York. 601-92

GENERAL ELECTRIC

RETARDING MAGNETS of alnico V, shielded by the aluminum frame, provide added protection against decalibration.

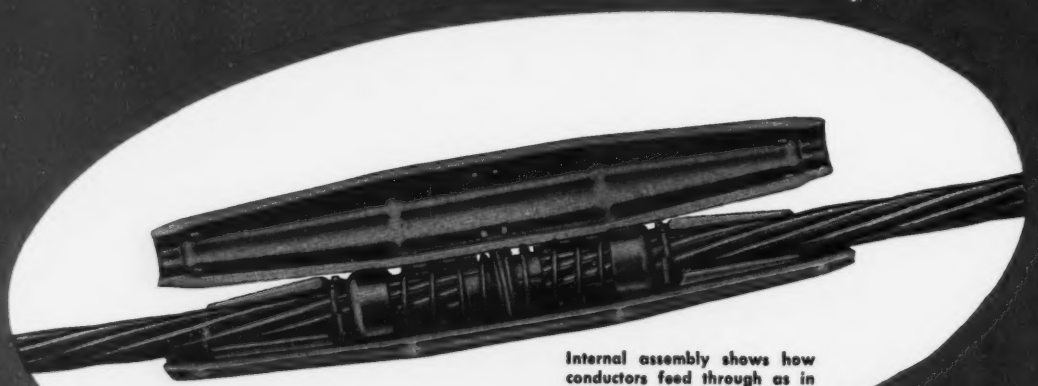


RELIEF GAPS are located so that the current-coil and potential-coil insulation will not be damaged by flashover.



MOLDED COIL insulation of I-50 meter securely holds coils to laminations and gives high dielectric strength and long life.

Reliable LIFTS THE LID on a New STRAIGHTLINE Splice



Internal assembly shows how conductors feed through as in a deadend. One jaw is removed for a better view.

SPLICE OPERATES LIKE A PAIR OF BACK-TO-BACK STRAIGHT-THRU DEADENDS

The new "55" Series Straightline Splice is the surest splice yet devised for strand . . . and *still* no tools are required.

FEATURES:

1. Burred, bent, or out-of-lay strands are either properly located or are refused by pilot cups.
2. Pilot cups prevent jaws from gripping conductor until conductor is "home".
3. Complete closure prevents entry of gritty materials that can interfere with proper functioning of gripping jaws.
4. With only a straight push conductors reach "home" with a definite *feel* and *sound*.

Write for new bulletin giving complete information. Reliable will gladly give you a demonstration — simply ask for it on your company letterhead.

Reliable ELECTRIC COMPANY

3145 CARROLL AVENUE
CHICAGO 12, ILLINOIS

OVER 45 YEARS OF SERVICE TO THE UTILITIES

POWER-LINE CONNECTORS and CONSTRUCTION SPECIALTIES

Meet
H. G. Barnett*

Westinghouse Electric Utility Engineering Department who would like to show, on the next few pages, how you can provide . . .

Better protection for your distribution investment

*"Barney" Barnett has worked in close cooperation with Utilities in every state of the nation. His wide experience has given him an intimate knowledge of every phase of power distribution. He and the product experts you will meet on the next few pages are a part of the Westinghouse team, available to help solve *your* specific problem.

Substations with a future help protect your system investment

Westinghouse Coordinated Substations not only meet today's load demands, but provide the flexibility vital for future changes in load requirements. They are your first steps in assuring the greatest return and long-time usefulness from your substation investment.

First, let's consider the level of protection: The components of a Westinghouse Coordinated Substation are engineered to work and fit together from the design stage, through manufacturing. Addition of a feeder is a simple matter of adding the compact switchgear unit. A transformer can be changed out readily when necessary. The load capability of the coordinated substation can be readily adapted to accommodate load growth and shifting load centers. An entire substation can be moved easily, quickly, and economically with a minimum of temporary disturbances to service and without sacrifice of protection.

Then look into these installation savings: Lay a foundation, throat-connect cubicles to the transformer, and tie in your feeders. It's as simple as that. And it certainly contrasts with the time and labor costs involved in field-assembled equipment.

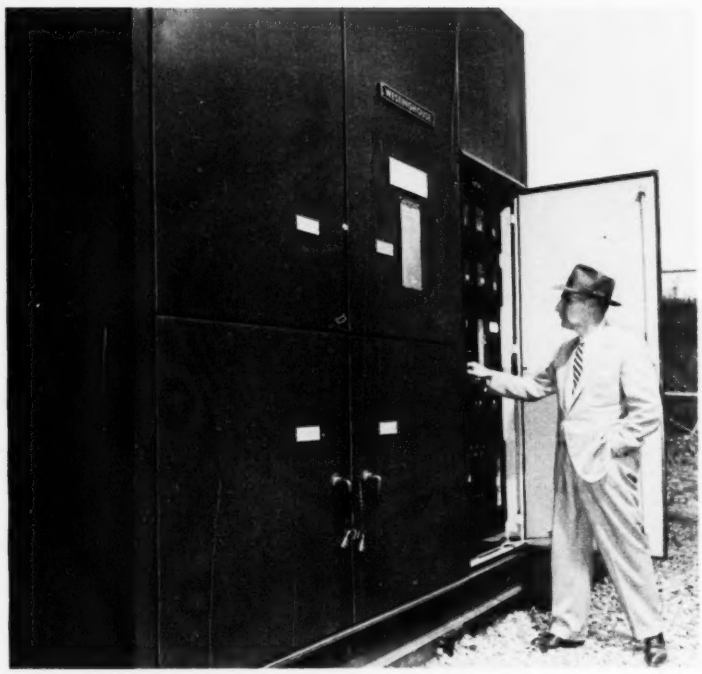
Booklet B-4061 will give further details on Westinghouse Coordinated Substations. Write for it. J-60811

YOU CAN BE **SURE**...IF IT'S

Drawout breaker design helps sustain better protection

First, it requires less maintenance. Second, essential maintenance is simplified.

Good workmen can do an even better job of maintenance with Westinghouse Drawout Breakers. The positive interlocking and accessibility of Westinghouse Metal-Clad Switchgear make it easy to interchange breakers in a few minutes with complete safety. Since the design takes full advantage of the "De-ion®" principle of arc quenching, maintenance of Westinghouse Breakers is reduced to a minimum.



Get all these advantages in single-feeder substations, too

The Westinghouse "CSP" Power Transformer provides all the advantages of factory coordinated equipment for single-feeder stations, too. With complete metering, regulating, and protective equipment built into an integral unit with the transformer, its neatness and safety features lessen community objections to installation in residential areas. When installed with underground leads, even protective fencing may be eliminated.

Westinghouse

. . . *"and now let's talk to Bob Rung of the Transformer Division about the latest in transformer protection:"*

YOU CAN BE **SURE**... IF IT'S

Simplified design for "CSP" breaker...

improves on the best protection a transformer ever had

It's a completely new breaker, now available in Westinghouse "CSP®" and "CSPB®" Transformers, single and three phase.

As you know, more than 20 years of service have proved that the breakers in Westinghouse Transformers provide the most accurate overload protection available . . . direct response to copper temperature. The new Type "LR" breaker, based on this same principle, assures even greater dependability because it is a simplified design.

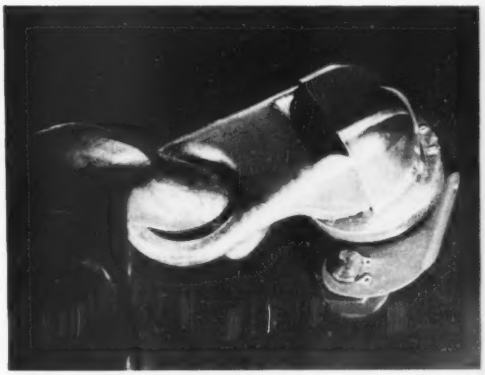
Fewer moving parts . . . just naturally add assurance of trouble-free service. *Increased contact pressure* . . . provides improved conductivity for unfailing performance. *New O-ring seal* . . . makes resetting easy as flipping a switch. *More compact, too* . . . most three-phase "CSP" and "CSPB" Transformers now fit into smaller tanks, substantially reducing both size and weight.

The new secondary breaker design is another reason why Westinghouse "CSP" (Completely Self-Protecting) Transformers provide better protection for your distribution investment. Not only does the breaker protect against overloads and short circuits, but also built-in arresters guard against lightning.

A copy of Technical Data 46-408 on the new "LR" breaker is available with full details.

J-70680

Continuous Load Check. A red warning light indicates a serious overload condition. This provides a continuous load check, making special load surveys unnecessary.

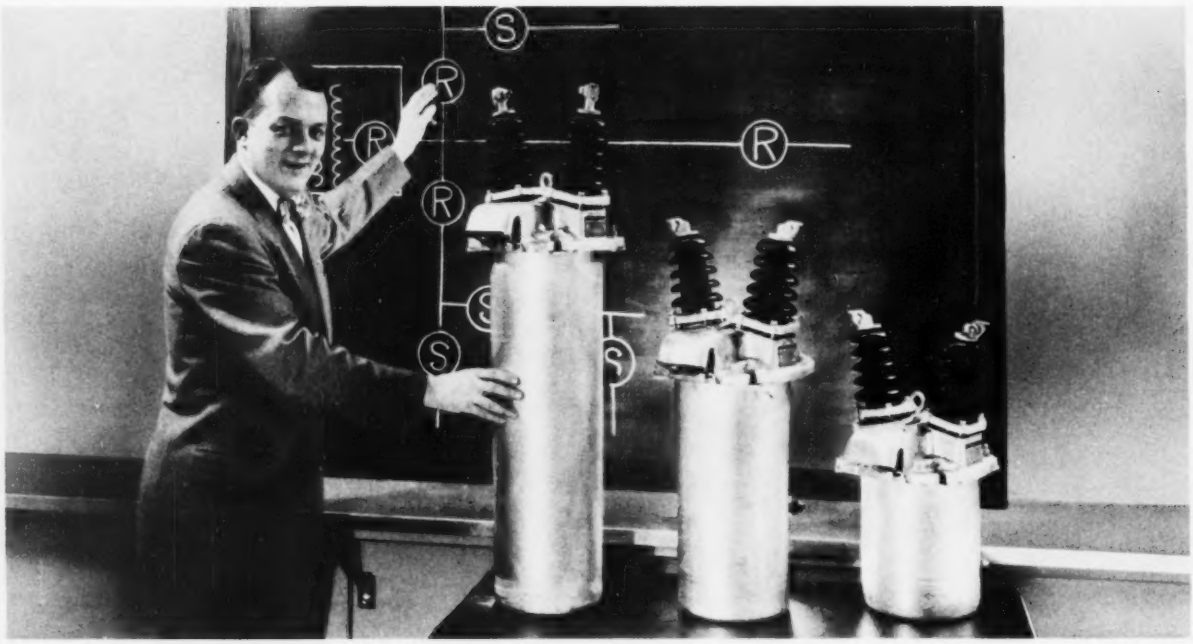


Burnout Protection. Dangerous overload trips breaker, preventing serious damage or burnout. Warning light remains on. If overload is temporary, and the crisis past, breaker may be reset with operating handle.

Emergency Service. When service must be maintained, in spite of dangerous overload, emergency control permits continued operation. Warning light remains on. Breaker still gives protection against short circuits.

Westinghouse

"Fred Reiber, Manager Switchgear Distribution Apparatus Sales, is the man to tell you about the protective advantages of reclosers and sectionalizers."



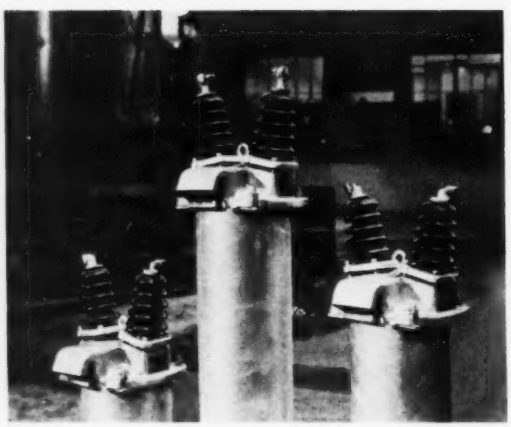
These Reclosers and Sectionalizers work better in new protective schemes because they're so simple

Here's a big opportunity for improving service and cutting service calls. We've helped innumerable utilities improve distribution systems by helping work out the most practical reclosing and sectionalizing schemes.

Westinghouse Reclosers and Sectionalizers work better in these coordinated automatic systems because they're inherently *simpler* than other types. The recloser operating mechanism has only 1/2 to 2/3 as many parts as others. The timing mechanism is hydraulic with no delicate relays, clocks or gears.

These devices are exceedingly *practical.* The recloser offers nine different combinations of instantaneous and time-delay settings. When reclosing after lockout, it operates on time delay, thus simplifying line pickup. And, if the fault persists, it locks out in *one* operation, not several.

The Westinghouse Sectionalizer is outstanding, too. Its momentary rating is 4000 amps, more than any other. Proper operation is insured by a magnetically compensated counting mechanism. Write for DB 38-680, DB 38-685, and DB 38-690 for more information on this superior equipment. J-60812



They're backed up by big-breaker engineering. Here reclosers undergo tests in the famous Westinghouse High Power Laboratory. We *know* they will perform right on the line.

YOU CAN BE **SURE**...IF IT'S

"To round out the Westinghouse story on protection, here's Relay Sales Manager, Frank Chapman."

New developments boost relay accuracy, improve protection

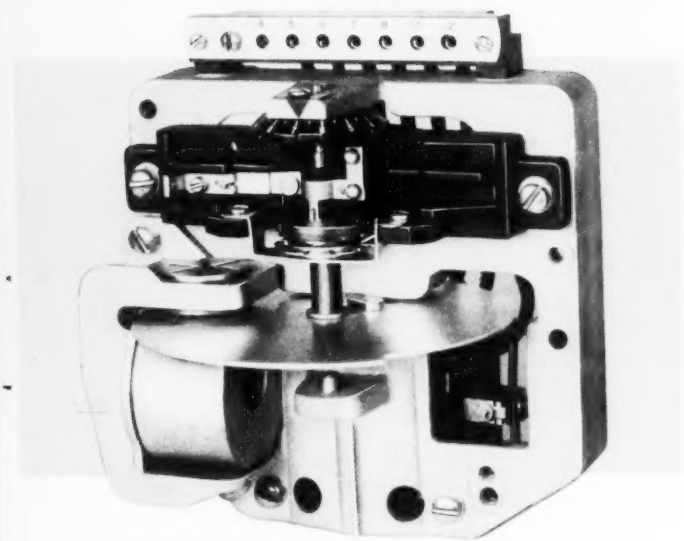
The new Westinghouse CO Relay enables you to match time curves much more accurately. This gives you faster, more precise relaying and a surer, safer switchgear operation.

The heart of this new relay is the "E" element. It has four separate and independent tolerance controls rather than the usual two. Thus, you can precisely adjust to the desired time curve without compromise. Three more factors contribute to high accuracy: low temperature error, low wave-form error, micrometer adjustment of the permanent magnet.

Just one of the factors that increase reliability of this new relay is a positive-action tap block with self-positioning taps. They provide a metal-to-metal contact between tap terminal and tap plate. In addition, the relay is built on a non-geared design with cast alnico magnet and one-piece, die-cast frame.

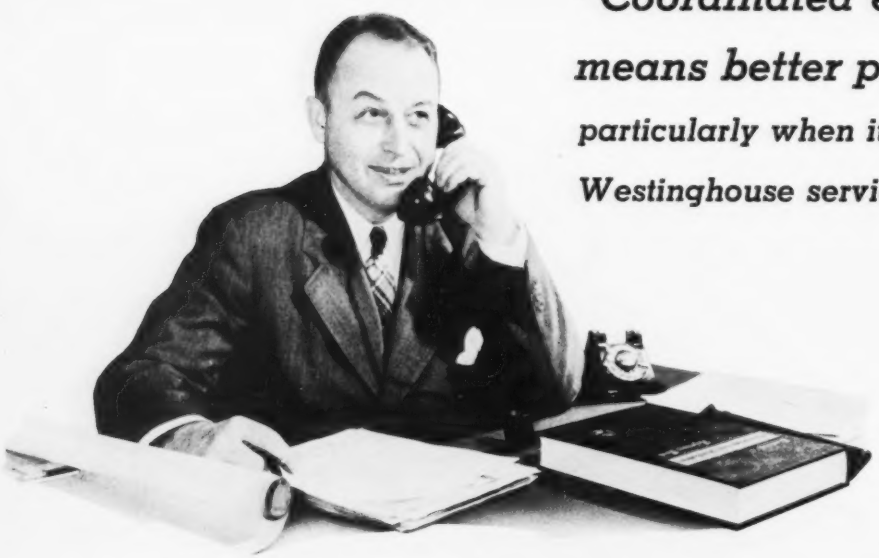
Write for booklet DB41-280 for complete details.

J-40441



Heart of the new relay is the "E" element which contributes to its greater accuracy.

Westinghouse



"Coordinated equipment means better protection . . . particularly when it's backed by a Westinghouse service like this!"

Westinghouse calls them Consulting and Application Engineers. They're my field counterparts, a highly trained group who devote full time to Utility problems and back up local application engineers. Here, for instance . . .

. . . is Stan Gaines (top right), C&A engineer who works out of the New York district office. Stan has had extensive experience with Utility distribution systems. He has made contributions to the design, application and operation of several lines of Westinghouse Distribution Equipment . . . most of which were made possible by close coordination with Utility organizations. Another good example is . . .

. . . Hank Madden (bottom right), a C&A engineer in our Southeastern District. Hank, like Stan Gaines, is a well-known authority on Utility problems. He holds several patents on his work with circuit breakers, transformers and sectionalizers.

C&A engineers can help you plan your distribution system for maximum savings in cost and adequate provision for future load requirements. Their intimate acquaintance with all phases of your activity and equipment enables them to assure you of optimum, long-term performance.

Fellows like Stan and Hank are strategically located in all sections of the country. They are available on a full-time basis to aid you in solving your problems . . . "on the spot." Don't fail to capitalize fully on their knowledge—backed by complete Westinghouse Engineering and Research.

Call your Westinghouse C & A engineer today for personalized C & A service—or specific equipment booklets. He'll give you prompt service. Or, if you prefer, write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. CP-1000

YOU CAN BE **SURE**...IF IT'S

Westinghouse

Looking ahead to years of service

CHASE ANTIMONIAL ADMIRALTY

(a patented alloy)

If you want condenser tubes that will stand up for years under tough field conditions, remember . . . Chase Antimonial Admiralty* Condenser Tubes last longer! It's the antimony that does it!

These great condenser tubes have enough antimony to resist dezincification. And, in addition, antimony is one inhibitor that will not weaken the tube. The metal starts with the right grain structure and retains it . . . it stays tough and withstands the stresses of heavy duty assignments.

You'll do better with Chase Antimonial Admiralty Condenser Tubes! Send coupon for FREE book on Condenser and Heat Exchanger Tubes.

CHASE WAREHOUSE STOCKS:
NEW YORK, BALTIMORE, NEW ORLEANS, LOS ANGELES,
also carried by —
Vinson Supply Co., Tulsa
Standard Brass & Mfg. Co., Houston.

*U.S. Pat. No. 2,061,921

FREE CHASE BOOK discusses corrosion problems and selection of proper alloy for condenser and heat exchanger tubes.

Chase Brass & Copper Co., Dept. EW-253
Waterbury 20, Conn.

Please send me Free Book on Condenser and Heat Exchanger Tubes.

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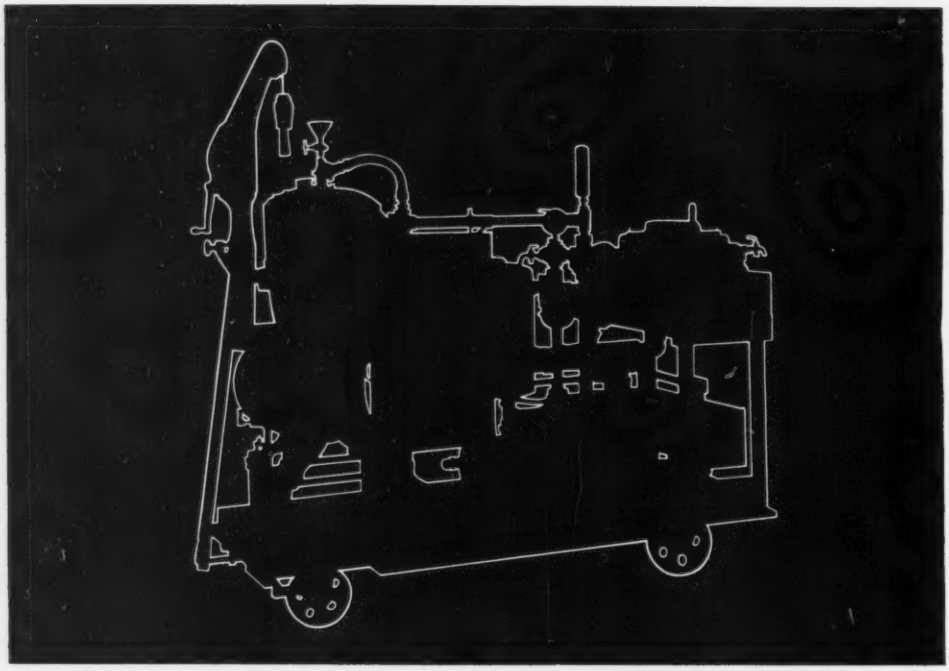
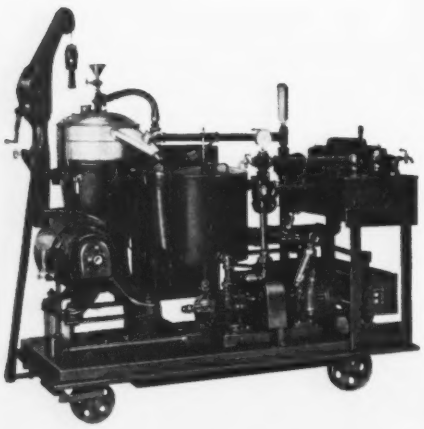
Boston	Detroit	Minneapolis	Providence	
Chicago	Houston†	Newark	Rochester†	(†sales offices only)
Cincinnati	Indianapolis	New Orleans	St. Louis	



OUTLINE FOR FOOLPROOF INSULATING OIL PURIFICATION

A De Laval Insulating Oil Purifier provides the most simple . . . safe . . . and reliable method of maintaining the dielectric of your transformer and circuit breaker oil. In the bowl of the De Laval centrifuge, water is ***continuously*** removed, and immediately discharged to waste.

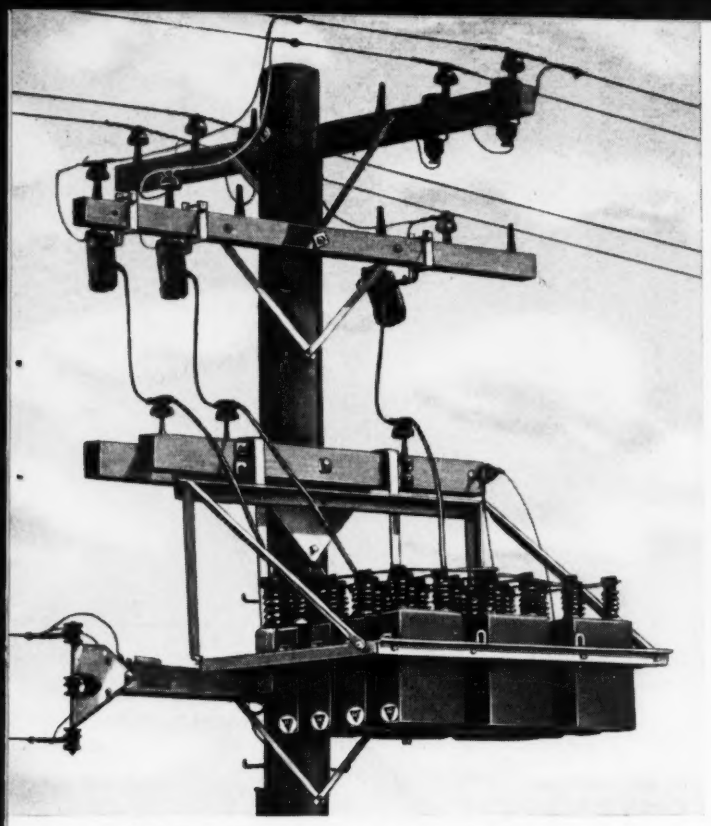


The De Laval Insulating Oil Purifier always operates at constant efficiency. It cannot suddenly lose its effectiveness. There is no danger that a batch of oil in the process of purification will go in an instant from a high to a low dielectric test.

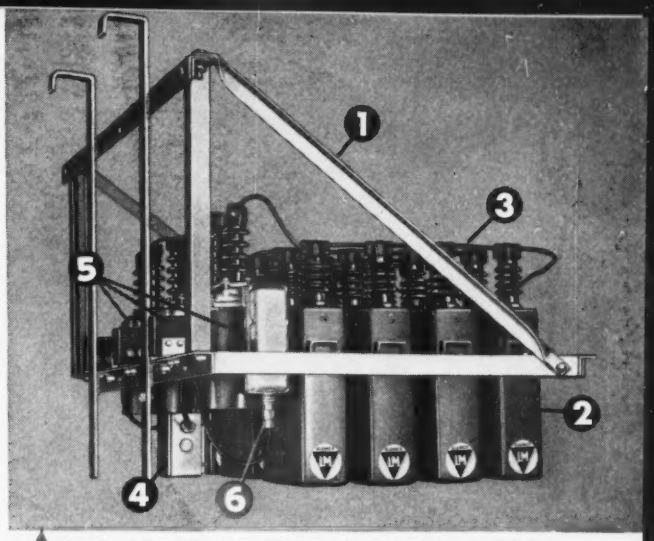
Other advantages of De Laval centrifugal Insulating Oil Purification include low operating cost, low temperature purification and high daily capacity.

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

DE LAVAL INSULATING OIL PURIFIERS



A 300 kvar switched capacitor rack serving a suburban area. Note the simple, compact arrangement and accessibility of the entire assembly. Wiring is completely bird-proof.



Details of the L-M racks. (1) Rugged angle steel rack. (2) Elemex Capacitors. (3) Neoprene-covered wiring with Neoprene terminal caps. (4) Weatherproof terminal box for low voltage control wiring is easily accessible. (5) L-M Type NR oil switches. (6) Weatherproof plug-in connection to switch.

New and Exclusive Oil Switch Plug-In Connection Simplifies Maintenance

A weatherproof plug-in connection and weatherproof plug at the base of the oil switch control housing permits the switch to be disconnected without disturbing any of the low voltage wiring. Only one easy-to-reach connection to break and the switch is ready to be removed for service. It's so simple that the three switches can be disconnected in less than a minute.

L-M's Open Rack Capacitor Assemblies Are Completely Wired To Save Linemen's Time

by **HAROLD T. ZAMZOW,** Manager, Capacitor Sales, Line Material Company

With completely assembled capacitor racks, wired at the factory, the cost of installation of either switched or unswitched banks is greatly reduced. This becomes a major factor when one considers both installation costs and the availability of capable linemen.

Bird-Proof Wiring

L-M's racks are mounted in strong angle-steel frames, and provided with lifting lugs. All high voltage connections are made with ¾" Neoprene-covered conductor. Bushings are covered with unbreakable Neoprene terminal caps. This provides an absolutely bird- and squirrel-proof assembly.

Switched or Unswitched Assemblies

Assemblies may be switched or unswitched. Switched racks are provided with L-M's motor-operated "NR" oil switch in each phase. These are electrically interconnected to give three-phase operation. Control connections are made to a weatherproof terminal box mounted in the rack. Only simple, low-voltage wiring is necessary. For control, L-M's Type CCV voltage-sensitive control is suggested. This control can be adjusted in the field without test equipment. Time clocks or pilot control also may be used.

Fully Tested and Guaranteed

Elemex Capacitors are 100% tested during and after manufacture, and the completely wired assembly, including switches, is thoroughly retested and guaranteed. Thus the operator using these assemblies is assured of dependable operation, with an appreciable saving in overall costs.

Available in Various Assemblies

L-M's completely wired capacitor assemblies are available in 5 kv and 15 kv racks up to 300 kvar switched or 375 kvar unswitched. Total cost of switched banks is as low as $5.66 per kvar, and unswitched banks as low as $4.52 per kvar, completely wired!

Get Full Information

For full information on ELEMEX Capacitors and L-M's completely wired assemblies, ask the L-M Field Engineer; or write Mr. Zamzow at Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL 104

Elemex Capacitors

Complete Coordinated Equipment for Distribution Today

LET'S LOOK AT THE FACTS

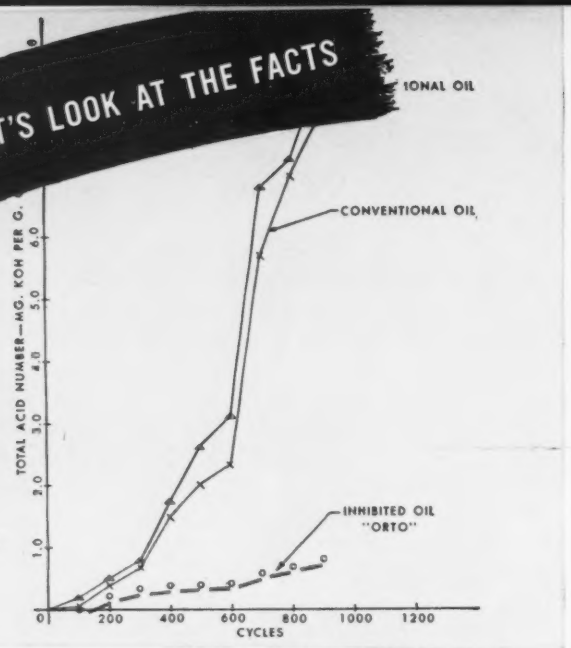


FIGURE 1—Comparison of acids formed by inhibited (ORTO) oil and conventional transformer oils in laboratory tests. Reduction of acid formation increases the life of the oil two to three times, and prolongs the life of the cellulose insulation.

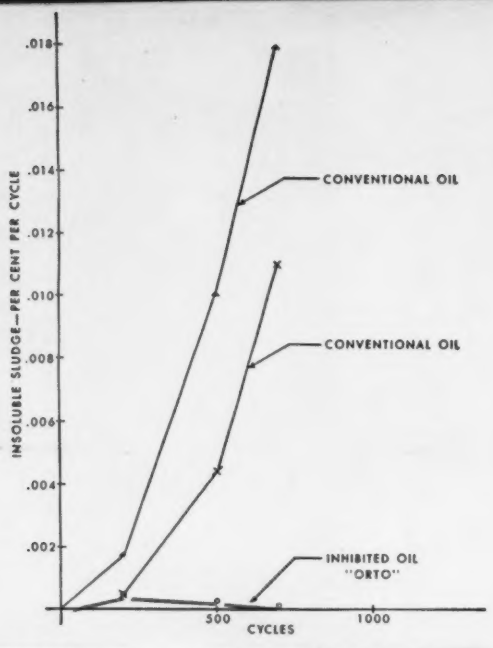


FIGURE 2—Comparison of sludge formation in conventional and inhibited (ORTO) oils in laboratory tests. The prevention of sludge formation appreciably lengthens life of the oil and the transformer, and maintains high overload capacity.

L-M's ORTO® Lengthens Transformer Life and Increases Overload Capacity

by **MARTIN I. ZWELLING,**
Chief Laboratory Engineer,
Transformer Division, Line Material Co.

The life of a transformer is largely determined by the life of the cellulose insulation. This, in turn, is dependent upon temperature of operation, formation of acids, and the length of time these two reactants are in effect.

Obviously the prevention of acid by an inhibitor eliminates one reactant (Figure 1). The prevention of sludge (Figure 2) modifies the other—temperature—by permitting free oil circulation, and thus keeps cellulose deterioration at a low rate. Surge strength and short-circuit strength are maintained at high levels throughout the transformer's life span.

Maintains Overload Capacity

Generally speaking, inhibited oil will improve overload capacity by maintaining the original capacity of the transformer over a greater proportion of its life. Actually, in high magnitude, short duration overloads, the temperature of the oil does not increase to any great degree, and heat affects only the cellulose insulation. But if the prevention of acid formation has protected the cellulose insulation from deterioration, the transformer is better able to handle a high short-time overload without damage.

In the case of long time, low magnitude overloads, the use of an inhibited oil such as ORTO has an even more marked effect. In conventional oils, overload capacity will be decreased as oxidation builds up increasing amounts of acid and blanketing layers of sludge (Figure 3). By preventing the formation of acids and sludge, the transformer maintains its initial high overload capacity for a greater proportion of its life (Figure 4).

Lengthens Transformer Life

If an operator obtains a certain life expectancy from a transformer under certain operating conditions, life will be increased with an inhibited oil under these same operating conditions. Or, with the same operating conditions and the *same life expectancy*, a certain increase in the overload is possible with ORTO.

Long term tests (Figure 5) and short term accelerated tests (Figure 6) have been made which show a marked degree of correlation (Figure 7). These tests indicate that the inhibitor in ORTO greatly prolongs oil life before acid and sludge deterioration commences, and that after this deterioration starts, ORTO follows the same gradual curve of any high grade conventional oil (Figure 8). The inhibitor has no harmful effects, it does not react with any other known inhibitor, and it may be blended with other oils, new or reclaimed, inhibited or non-inhibited. Naturally when ORTO is blended with another oil a certain amount of dilution occurs which reduces the effective life-extension properties of the inhibitor to the extent that ORTO is diluted. The overall effect of ORTO can be safely judged from the diagram.

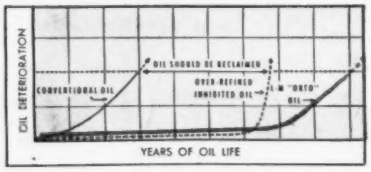


FIGURE 8—Comparative curves show the deterioration in service of a conventional oil, an inhibited over-refined oil, and ORTO brand oil, in which deterioration, when it finally starts, follows the same gradual curve as any high grade conventional oil.

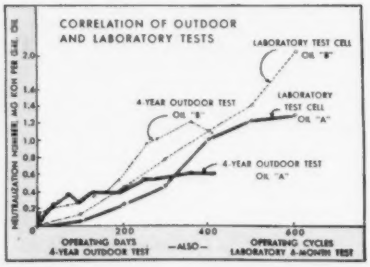


FIGURE 7—Typical curves showing the close correlation between the 4-year outdoor tests and the laboratory tests on two oils. This close correlation prevailed throughout on the various oils tested and in the wide variety of tests made.

FIGURE 3—Laboratory test coil after the equivalent of about 18 years service using a good grade of conventional oil. Notice the heavy sludge deposits, which have clogged oil passages, causing higher temperatures, deterioration of insulation, and lower overload capacity.

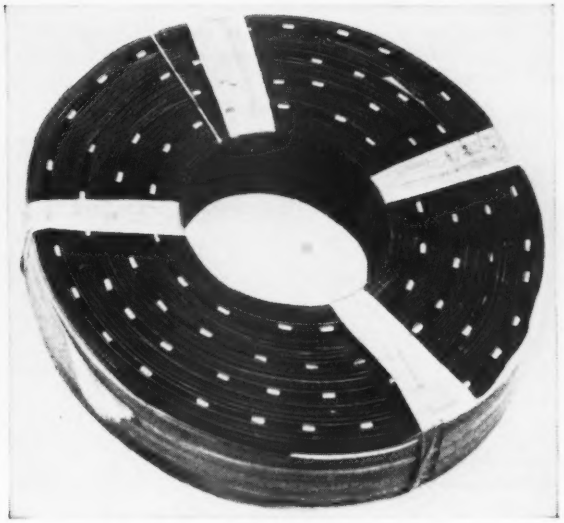


FIGURE 4—Here is an identical coil, after operating for the same period of time under the same conditions except that the oil was ORTO. Acid and sludge formation has been prevented; oil passages are clear; initial overload capacity and impulse strength have been maintained.

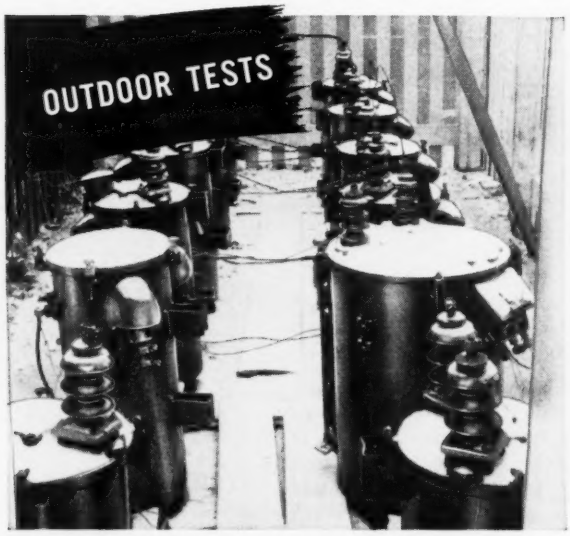


FIGURE 5—Outdoor tests started some years ago were used as a basis for developing accelerated laboratory tests. These outdoor tests were closely checked against other long time tests run by oil companies and utility companies, and were correlated with laboratory procedure.

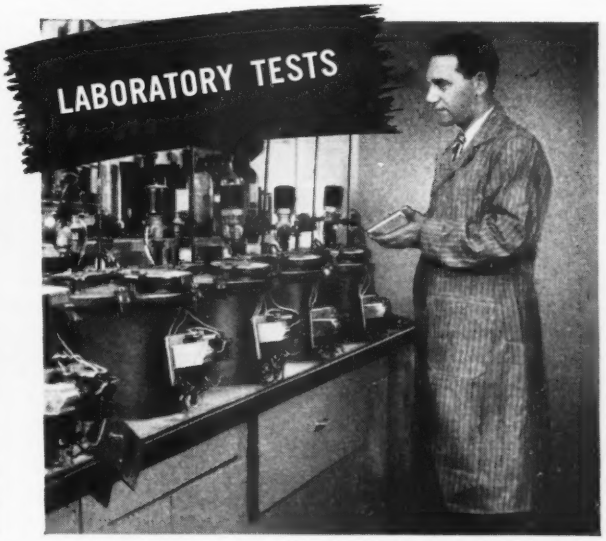


FIGURE 6—Laboratory equipment in which conventional and inhibited oils were tested under closely controlled conditions. The laboratory test permitted precise recording of acid and sludge formation and of deterioration of insulation, wire, and other parts of the transformer.

Look at the facts! Get details on L-M Round-Wound Transformers

L-M Round-Wound transformers consist of a wound core, with round coils wound directly onto the core, which therefore is not cut or unwound, and air gaps are not introduced.

Because of the design and the long, round coils, the transformers offer better regulation, high short time overload capacity, high impulse level and high short circuit strength, low exciting current, and better loss ratios. And they are filled with ORTO, L-M's outstanding Oxidation Resistant Transformer Oil!

Get the facts from the L-M Field Engineer, or write Mr. Zwelling at the Transformer Division, Line Material Company, Zanesville, Ohio (a McGraw Electric Company Division).

LINE MATERIAL
Transformers

LM ORTO

85

Complete Coordinated Equipment for Distribution Today

Interrupting ratings now up to 6000 amperes at 4.8 kv, 4000 amperes at 14.4.

Complete range of nominal load ratings from 25 to 200 amperes, for 2.4 to 14.4 kv service, makes available the greatest number of sectionalizing points in this class.

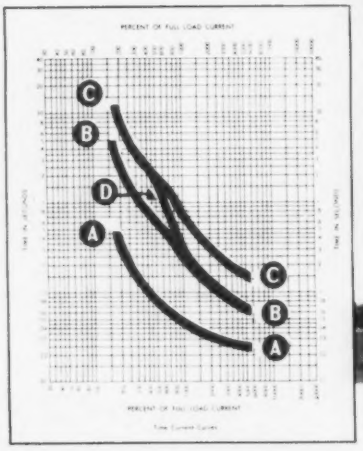
Only Recloser with:

Choice of four time-current curves, ten tripping sequences, which gives maximum flexibility in meeting all coordination problems on heavily loaded distribution circuits.

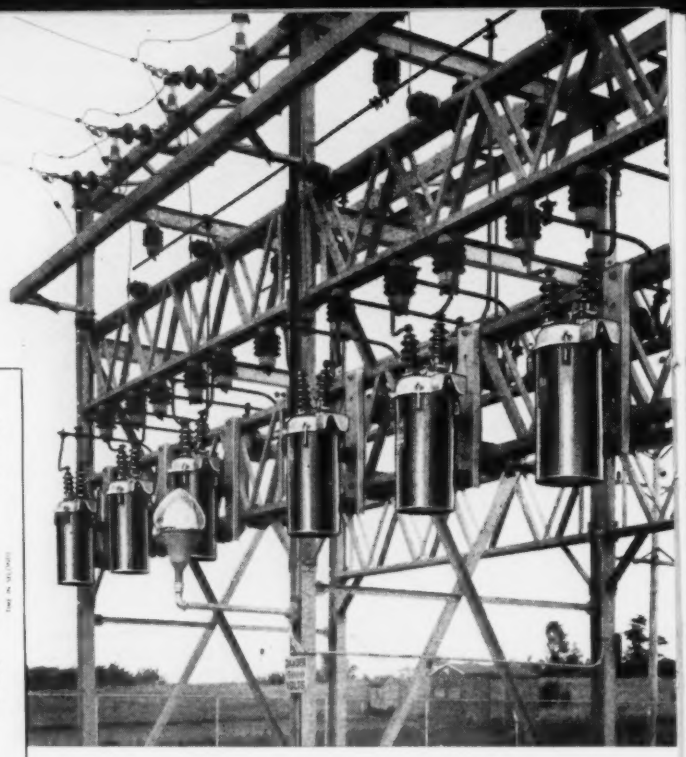
Full power-class design, with 110 kv basic insulation level.

Clamp-on bushings, with plated Universal terminals for copper or aluminum conductor.

Oil Cross Blast arc interruption insures rapid clearing of heavy faults.



Only recloser with choice of 4 time-current curves and 10 operating sequences. Coils and sequences are easily changed in the field.



Kyle Type L Reclosers at a middle-western power company substation, where they help assure uninterrupted service to an urban area.

L-M Increases Interrupting Rating, Adds 200-amp Rating to Kyle Type L Recloser

To protect substations and feeders with heavier loads and higher fault currents, L-M has added a 200-ampere rating to the Kyle Type L Recloser, and has increased interrupting ratings appreciably.

The higher interrupting ratings are based on extensive testing of production reclosers, as well as field experience, and apply to Kyle Type L Reclosers already delivered.

The new higher nominal load rating involves a new coil and some increase in the capacity of certain current carrying parts. The changes can easily be made on any Type L reclosers now in service if desired.

The Kyle Type L not only handles present heavy loads, but it offers increased capacity for the future, plus the present benefits of Type L performance and economy. It provides complete coordination with fuses and other reclosers in series, with a corresponding reduction in fuse blowing and service calls.

Heavy Duty
Type L Single Phase
Nominal Rating 14.4 kv, BIL 110 kv

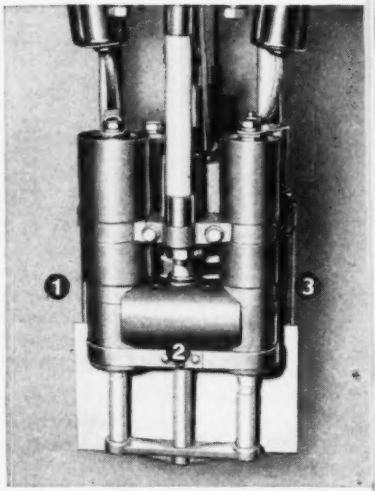
Rating Amperes	Minimum Tripping Current Amperes	Interrupting Ratings* Symmetrical RMS Amperes at Maximum Phase to Phase Nominal Voltage of: 4.8 kv	14.4 kv
25	50	1500	1500
35	70	2100	2100
50	100	3000	3000
70	140	4200	4000
100	200	6000	4000
140	280	6000	4000
200	400	6000	4000

*Recloser interrupting ratings are based on the maximum test circuit X/R ratio of not less than 8, and the asymmetrical rating in total RMS amperes is 1.4 times the symmetrical ratings given in the table.

Get the Details

Ask the L-M Field Engineer for full information on the Type L and other Kyle Reclosers providing complete, coordinated protection; or write for a copy of bulletin CR-1A. Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

Kyle Reclosers are filled with ORTO®, L-M's oxidation-resistant transformer oil.



Rapid oil cross blast arc interruption. Double contacts draw two arcs in series. Gas from one arc at 1 blasts oil in chamber, 2, across arc at 3, extinguishing it.

LINE MATERIAL
Kyle® Reclosers

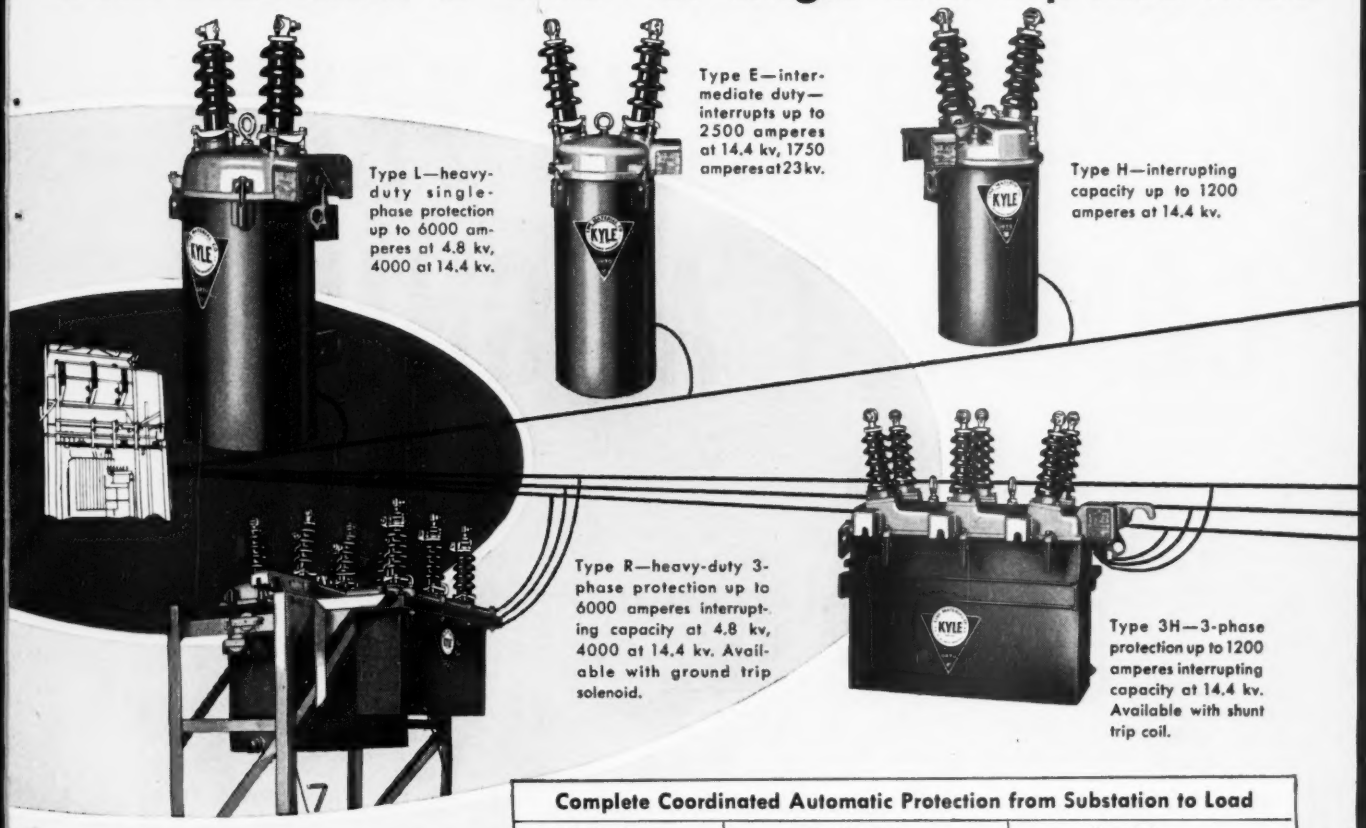
99

COMPLETE COORDINATED AUTOMATIC PROTECTION FROM SUBSTATION TO LOAD

L-M now offers

Complete Automatic Recloser Protection

from Substation to Load—for single and 3-phase lines



Type L—heavy-duty single-phase protection up to 6000 amperes at 4.8 kv, 4000 at 14.4 kv.

Type E—intermediate duty—interrupts up to 2500 amperes at 14.4 kv, 1750 amperes at 23 kv.

Type H—interrupting capacity up to 1200 amperes at 14.4 kv.

Type R—heavy-duty 3-phase protection up to 6000 amperes interrupting capacity at 4.8 kv, 4000 at 14.4 kv. Available with ground trip solenoid.

Type 3H—3-phase protection up to 1200 amperes interrupting capacity at 14.4 kv. Available with shunt trip coil.

New Kyle heavy-duty Type R 3-phase recloser makes L-M first to offer a complete, coordinated line

As shown in the illustration, L-M now provides complete automatic protection from substation to user, in both single-phase and 3-phase recloser units.

The new Kyle Type R provides up to 100,000 kva interrupting capacity—up to 6000 amperes—ample for a good-sized substation or for heavily loaded feeders with high fault currents. The Kyle Type 3H completes the 3-phase line with up to 1200 amperes interrupting capacity.

In single-phase, the Kyle Type L provides up to 6000 amperes, for substation or heavily loaded feeders; the Type E covers the range from 1200 to 2500 amperes, and the Type H provides single-phase protection up to 1200 amperes.

Ask the L-M Field Engineer for information and bulletins on the complete Kyle line; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

Complete Coordinated Automatic Protection from Substation to Load

Distribution Class Nominal Voltage Rating 14.4 kv BIL 95 kv			Intermediate Duty Nominal Voltage Ratings 23 kv BIL 150 kv				Heavy Duty Nominal Voltage Ratings 14.4 kv BIL 110 kv			
Single-Phase Type H Three-Phase Type 3H			Single-Phase only Type E				Single-Phase Type L Three-Phase Type R			
Rating Amps.	Min. Trip	Inter. Rating* 14.4 kv	Rating Amps.	Min. Trip	Inter. Ratings* 14.4 kv	23 kv	Rating Amps.	Min. Trip	Inter. Ratings* 4.8 kv	14.4 kv
5	10	150	5	10	200	125	....	...	....	....
10	20	250	10	20	400	250	....	...	....	....
15	30	375	15	30	600	375	....	...	....	....
25	50	600	25	50	1000	625	25	50	1500	1500
35	70	840	35	70	1400	875	35	70	2100	2100
50	100	1200	50	100	2000	1250	50	100	3000	3000
			70	140	2500	1750	70	140	4200	4000
			100	200	2500	1750	100	200	6000	4000
							140	280	6000	4000
							160#	320	6000	4000
							185#	370	6000	4000
							200**	400	6000	4000
							225#	450	6000	4000
							280#	560	6000	4000

*Recloser interrupting ratings are based on the maximum test circuit X–R ratio of not less than 8 and the asymmetrical rating in total RMS amperes is 1.4 times the symmetrical ratings given in the table.
#Available in three-phase Type R only. **Available in single-phase Type L only.

For Ground Fault Tripping: Type R heavy-duty 3-phase recloser is available with built-in ground trip solenoid and auxiliary current transformer. Type 3H is available with a shunt trip coil which may be used for ground fault tripping with suitable auxiliary equipment.

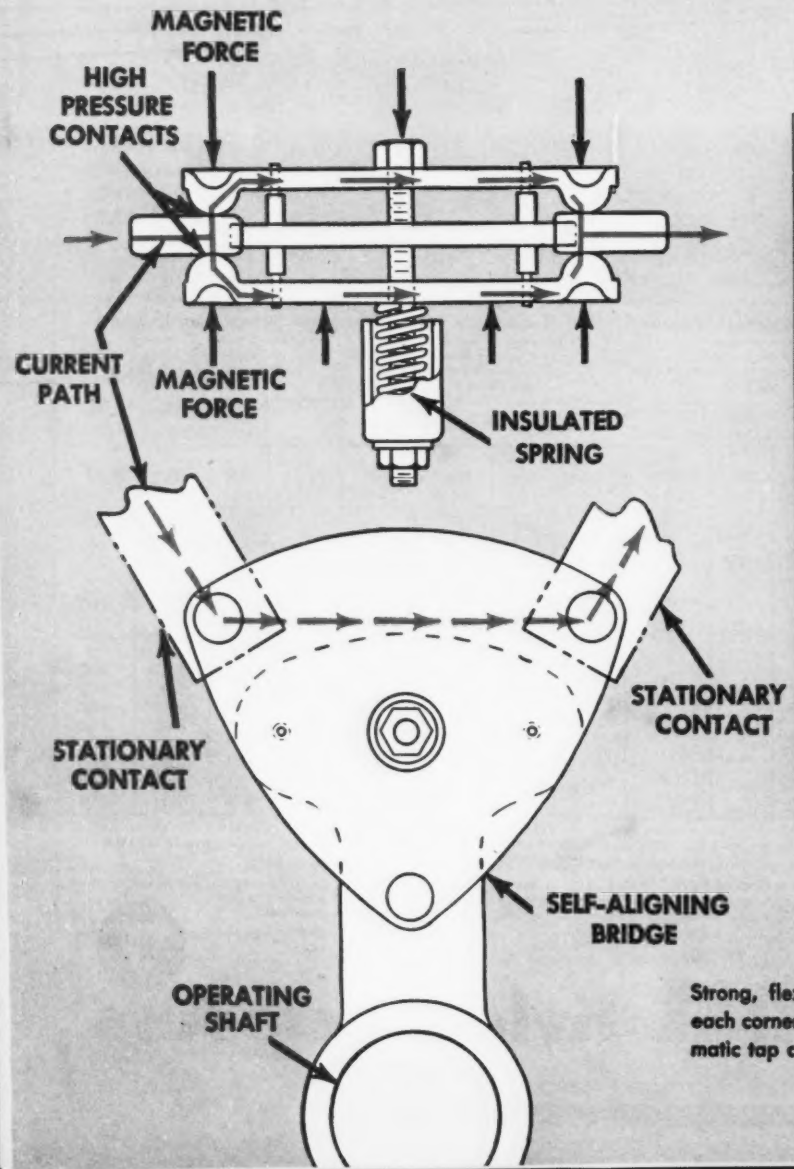
100

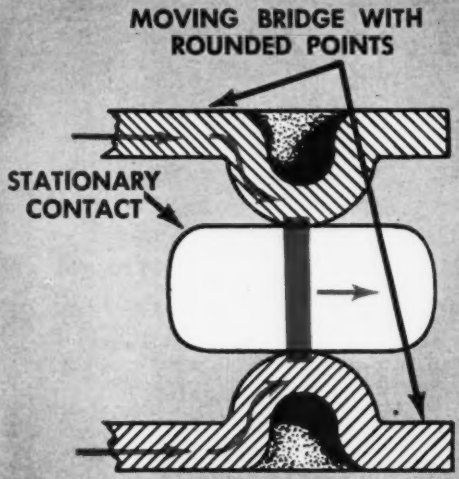
LINE MATERIAL Kyle® Reclosers

COMPLETE COORDINATED AUTOMATIC PROTECTION FROM SUBSTATION TO LOAD

new tap changer design

MAINTAINS TRUE CONTACT ALIGNMENT





Rounded point of contact against the stationary blade sets up one positive current path in each parallel bridge member. Magnetic forces increase pressure during short circuit conditions.

Strong, flexible spring action maintains equal pressure on each corner of the triangular bridging parts for perfect automatic tap changer alignment.

Uses New Contact Principle to Assure Cool, Long-life Operation on Allis-Chalmers Power Transformers

HERE'S A NEW TAP CHANGER for de-energized operation, using a new contact principle that keeps it cool in operation and extends operating life. Designed for use on Allis-Chalmers power transformers, the tap changer meets the approval of utilities which have sought an improved tap changer performance. It helps Allis-Chalmers power transformers do a good job better.

Here's How It Operates

A positive, fixed current path established under high unit pressure is the basic design principle of the new tap changer. Two sets of rounded contact points establish a low-resistance path when they meet the flat stationary contacts on the tap changer panels. A strong wiping action thoroughly cleans contacts whenever tap positions are changed. And elimination of carbon formation adds years to tap changer service life and lowers contact resistance.

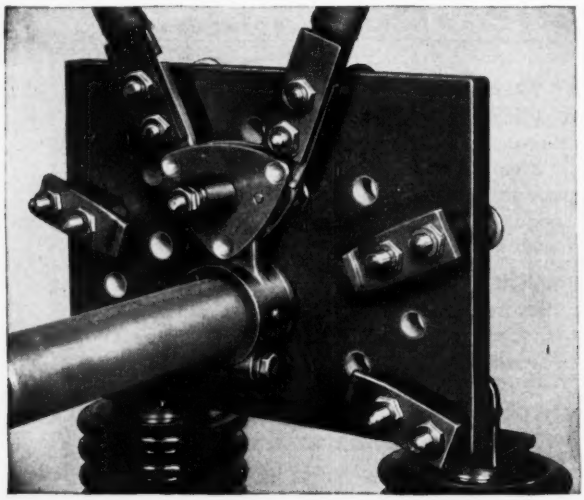
Equal Contact Pressure

The movable contact bridge is designed so that the current travels through parallel members between the stationary contacts. This creates magnetic forces that prevent "throw open" action when a short circuit occurs on the system.

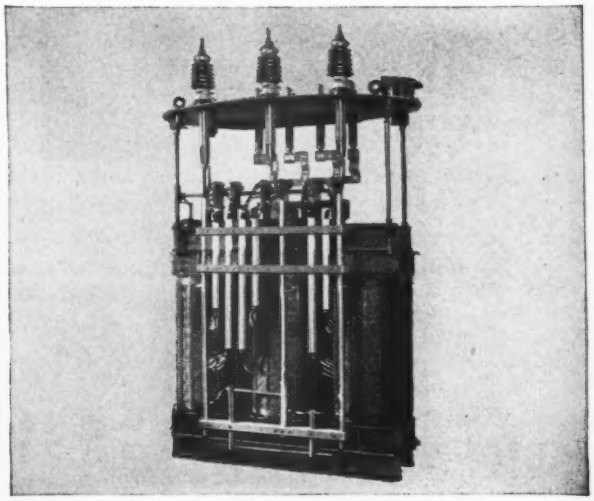
To maintain equal pressure at points of contact, flexible spring action operates between fixed limits. And the self-aligning bridge arrangement assures automatic and true alignment for each operation.

If you haven't seen the technical sheet describing the tap changer in greater detail, get one from your local A-C representative today or write Allis-Chalmers, Milwaukee 1, Wis.

A-3755



Rounded edges and insulated parts of the tap changer assembly reduce voltage stresses and minimize corona. Oil leakage holes prevent air pockets around mounting bolts.

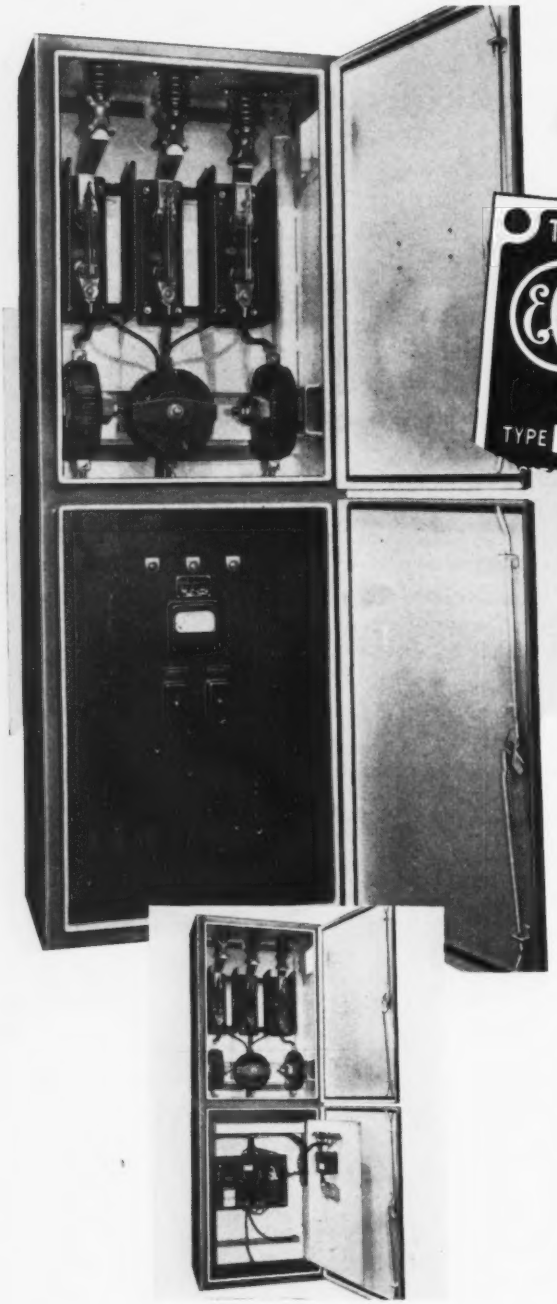


The new tap changer is easily accessible for periodic inspection through the cover handholes. Tap positions are changed in all phases simultaneously.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

choose EC&M



Two views of a 2300 volt EC&M VALIMITOR aligning-type cubicle starter with self-contained bus at top for connecting power to all the starters for this installation. Door interlock provides "safety" against opening disconnect switches under load.

FOR 2300-4600 VOLT MOTORS

OVERLOAD & SHORT CIRCUIT PROTECTION in a *single unit*

2-WAY PROTECTION with new EC&M Bulletin 1180-3 THERMAL-MAGNETIC Overload Relays. Instantaneous trip *magnetically* on short circuits... inverse-time trip *thermally* on overloads. Independent snap-action silver contacts for instantaneous and thermal trips help locate trouble when a shutdown occurs.

CONTINUOUS PROTECTION without blind spots is an inherent feature of EC&M VALIMITOR Starters, because the maximum fault current (KVA capability may be infinite) is limited to 25,000 KVA (steady state current) by EC&M VALIMITOR coils. Interruption of the current is by the well-known high interrupting capacity Type ZHS Contactor. No fuses to replace.

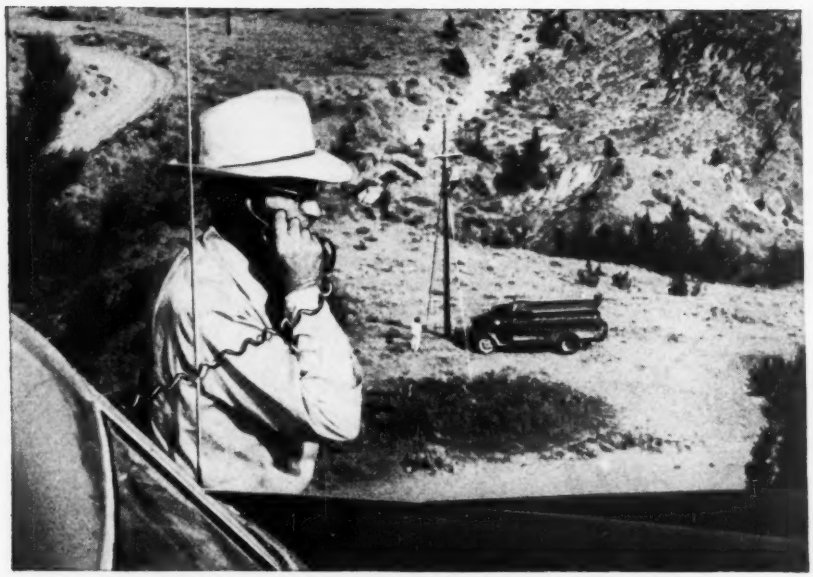
UNDER VOLTAGE PROTECTION—When voltage dips or power fails momentarily, motor will re-accelerate if normal voltage returns in two seconds or less. The contactor remains closed down to a low voltage with full spring pressure on the contacts. At about 25% control voltage, the contacts break cleanly—do not stick or burn.

WRITE FOR T9-117 REPRINT BULLETIN

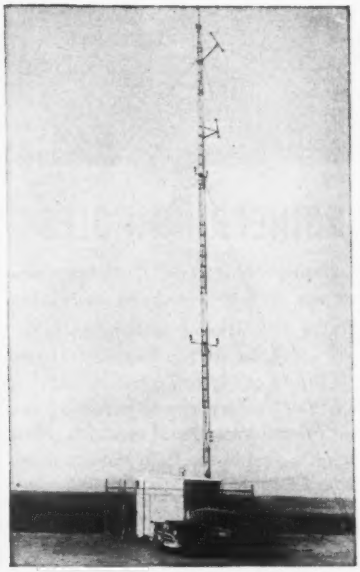
THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO

Montana-Dakota Utilities Co. reports on vast G-E 2-WAY RADIO NETWORK:

"KEY TO EFFICIENT SERVICE...LOWER OPERATING COSTS!"



Efficient Repairs. Line Foreman, Richard Kennedy, reports repair crew progress to headquarters. General Electric 2-way radio increases manpower production.



A Transmitting Station in the $250,000 Montana-Dakota Utilities Co. radio network. Also serves as relay station for offices or cars beyond normal direct reception range.

Instant Crew-To-System Dispatcher. Power is cut off or resumed in seconds. G-E 2-way radio is dependable under all weather and emergency conditions.

THE Montana-Dakota Utilities Company serves 63,000 electric and 65,000 gas customers with a vast network of power transmission and gas pipe lines. To increase operating efficiency and keep pace with the demands of today's expanding service, they picked General Electric 2-way radio! One of the largest of its kind in the nation, this network installation includes 26 fixed transmitting stations, 45 remote control units and 150 mobile radio-telephones.

You can put your confidence in—

GENERAL ELECTRIC

THE GENERAL ELECTRIC CAS* MAN

...can give you expert advice on the radio system best suited to your needs. Call him today at the local General Electric office or send us this coupon.

**Communications Advisory Service*

1876 75 1953 YEARS OF ELECTRICAL PROGRESS

General Electric Company, Section 1923-9
Electronics Park, Syracuse, N. Y.

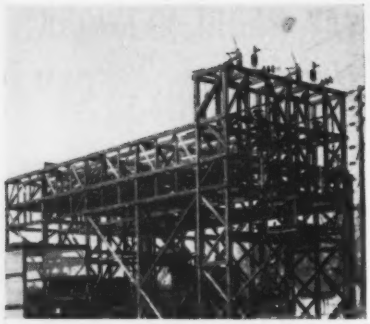
Please send me complete information on General Electric 2-way radio communications equipment.

NAME.....

COMPANY..... TITLE.....

ADDRESS.....

CITY..... STATE.....



ENGINEERING NOTES

Operating Men Point Out Additional Savings With New Ground Rod Driver

OUR ADS have already told you that one man using a Kearney Ground Rod Driver can install a rod in less than half the time formerly required by two men using conventional methods. Now, our customers in the field have pointed out additional savings possible with the tool.

First of all, we know that diameter of the ground rod has little to do with the conductivity of the ground. For example, studies prove that a ⅜" rod driven to the same depth as a 1" rod in the same soil has the same grounding efficiency. The only reason engineers specify the larger rod is to get the physical strength necessary to permit sledge-hammer driving to desired depth without buckling. But with the Kearney Driver it is actually easier to drive the smaller rod, and with absolutely no danger of bending. Less dirt to displace ... less resistance to the passage of the rod.

More important, look at the reduced cost. A ⅜" rod costs less than half as much as a ⅝" rod of equivalent length! Multiply this figure by the number of rods you plan to use this year and you quickly see how much saving is involved. Or, turn it around ... specify a rod twice as long as you've been using, get much better grounds ... with no increase in material cost and with *far less* labor cost for driving!

Either way it will pay you to write today to Dept. EE-1 for more information.

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. GUELPH, ONT.

"The Mark of Quality Products"

Always Specify **KEARNEY**

Color Identification Eliminates Fuse Link Confusion
Each type of Kearney Fuse Link is packaged in a carton printed with its own separate, distinct color combination. This extra Kearney feature makes identification almost automatic, prevents errors in reading labels.
PULL-TAB FUSE PAK
5 AMP

Reduce

Install the **RIGHT LINK**

THE TRIP-O-LINK

THE TRIP OUT

THE TRIP-O-MATIC

Kearney Cutouts and Kearney Fuse Links... *Designed-Matched for Better Performance*

IT IS TRUE that Kearney Fuse Links will work well in any good cutout regardless of make. That's because the fuse link is the center of equipment operation ... but, only by using Kearney Fuse Links in Kearney Cutouts can you take full advantage of the extreme accuracy and reliability built into Kearney line protection equipment.

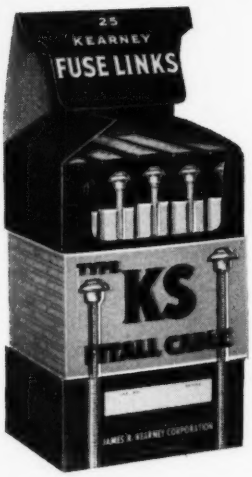
Follow the lead of the design engineers who have carefully computed our time-current fuse curves. For accurate, system-wide coordination, specify Kearney Cutouts and Kearney Fuse Links. Complete curves and data on all the Kearney Fuse Links are yours for the asking.

JAMES R. KEARNEY CORPORATION

4224-42 CLAYTON AVE., ST. LOUIS 10, MO.

Canadian Plant—Guelph, Ont.

YOUR PROTECTION *Cost*
Use KEARNEY FUSE LINKS



LOOK at your records. If you have been dropping loads, losing revenue, damaging equipment needlessly because of faulty fuse links . . . then you know that cheap fuse links are never inexpensive. Low first cost — yes, but unnecessary outages quickly drain away any savings on purchase price. That's why it will pay you to standardize on the industry's standard . . . Kearney Fuse Links.

They cost a little more, but they lead the field because they are a quality product, precision-built for accurate, proved performance. When you specify Kearney Fuse Links you make certain that your system has the lasting, coordinated protection and service continuity that today's load demands.

Fusing the Kearney Trip-O-Link

at the RIGHT PLACE.....

For Prompt Isolation of Troublesome Circuits—While Maintaining Service on Adjacent Lines . . .

TYPE 200

Certain circuits may prove to be more troublesome than others. When a line is subject to damaging long-time overloads and surges, continuity of service in adjacent circuits demands prompt action in isolating the troublesome line. The low temperature operation of this link assures that overloads up to 150% of the fuse rating can be carried for one hour without damage to the fuse or fuse cutout.

For Reducing Outages on Circuits Subject to Switching and Lightning Surges . . .

TYPE KS

Where switching, motor-starting and lightning surges are common, maintain service by using the Type KS Fuse Link. The overload capacities of the Type KS and Type 200 are identical; however, the surge capacity of the Type KS is twice that of the Type 200. The slow speed characteristic of the KS link provides proper coordination with circuit breakers as well as other fuse links.

For Distribution Transformer Overload Protection plus Extra High Surge Capacity . . .

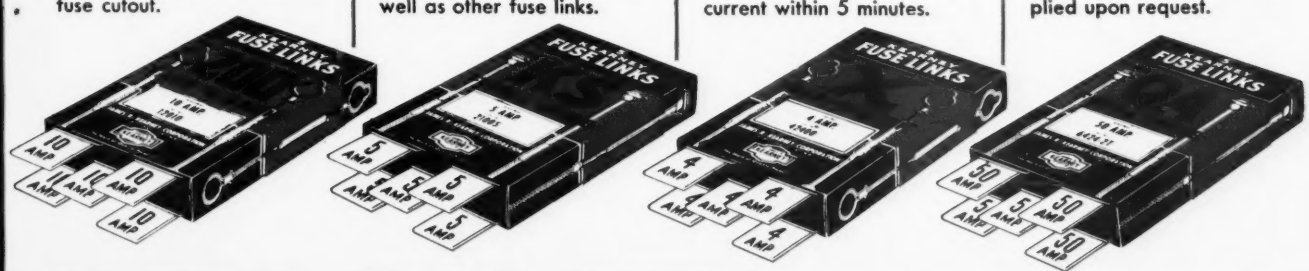
TYPE X

Designed to match the safe loading curves of distribution transformers, the Type X Fuse Link keeps transformers in service during heavy overload periods and surges, and yet fuses in an instant when faults persist. The extra high surge capacity means satisfied customers and lowered expense due to unnecessary outages. The Type X Fuse will open 230% of rated current within 5 minutes.

For Opening 150% of Rated Load Within 5 Minutes . . .

TYPE QA

The QA link is designed to open at a lower percentage of rated current and therefore will fuse more rapidly than fuse links of the same ampere rating which have been designed to open 230% of rated load within five minutes. For working out coordination problems involving all Kearney Fuse Links, minimum melting and total clearing time-current curves will gladly be supplied upon request.



PRODUCTS *for Better Construction — Safer Maintenance*

CROUSE-HINDS EV Series

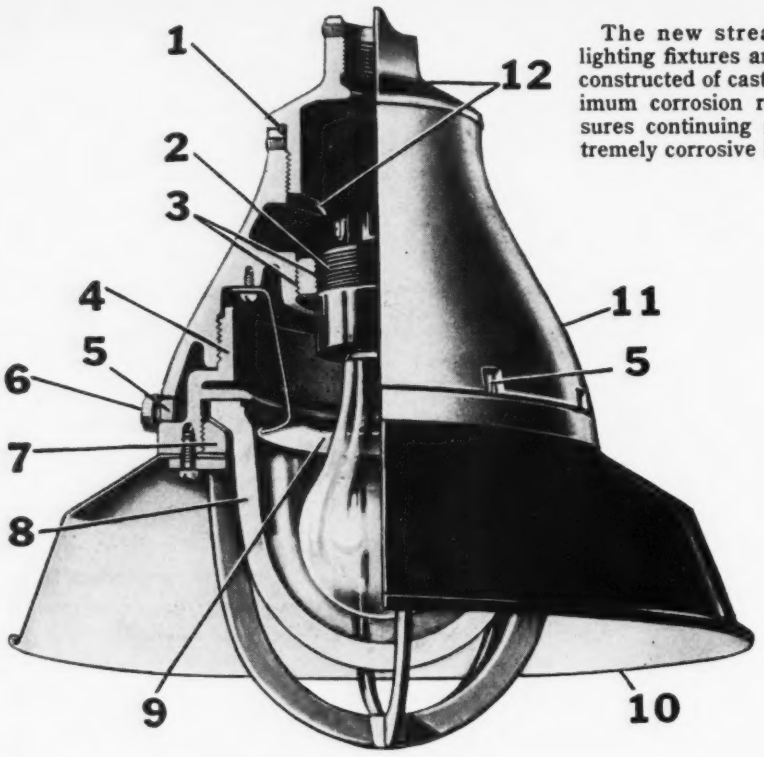
have been redesigned to give you:

EASIEST installation

EASIEST maintenance

HIGHEST efficiency

This adds up to big savings on every installation!

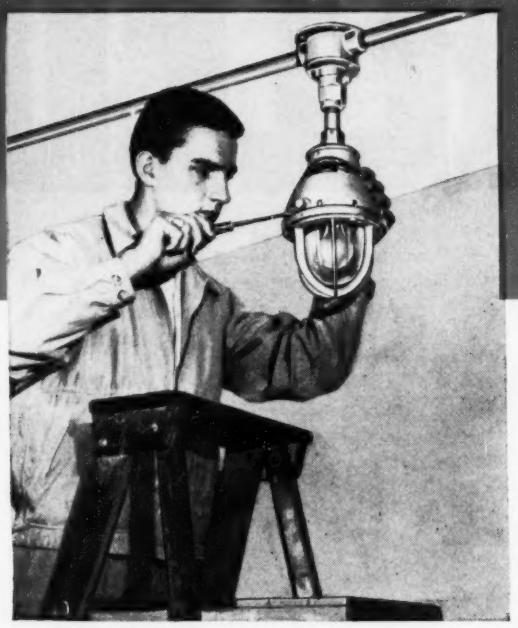


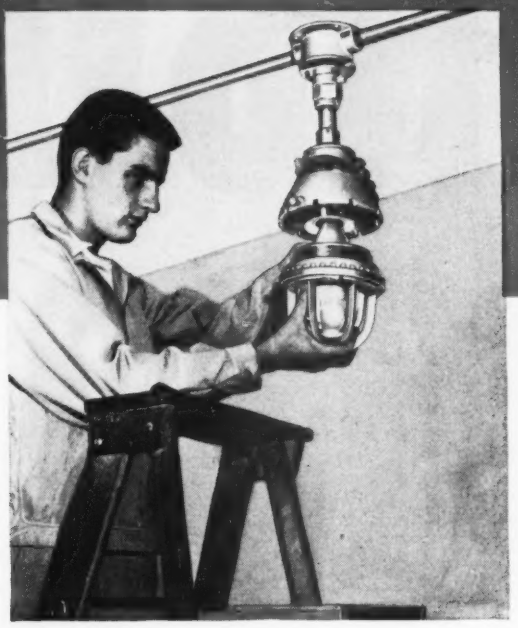
The new streamlined EV lighting fixtures are completely constructed of cast metal. Maximum corrosion resistance insures continuing safety in extremely corrosive locations.

1. Rubber O-ring gasket . . . seals joint against dirt or liquids.
2. New improved shock-absorbing receptacle has "universal" action . . . absorbs shock from *any* direction.
3. Threaded joints are flame tight . . . no sealing compound or external seals are required.
4. Lightweight one-piece assembly of globe, holder, guard and reflector is threaded high up inside of hood . . . no liquid or dirt can enter.
5. Notches in hood and globe holder . . . easy to loosen with a screwdriver.
6. Large knurled thumb screw . . . sets between notches for positive locking.
7. Globe retaining ring and cushioning gasket.
8. Heat and impact resisting globe. The accurately ground flange, essential for safety, is protected in a factory assembled joint . . . never exposed to damage.
9. Auxiliary reflector . . . etched Alzak aluminum . . . eliminates "trapped" light.
10. Porcelain enameled steel reflector.
11. Cast aluminum hood.
12. Cast aluminum body . . . has two openings for easier wiring from either side.

CONDULETS · AIRPORT LIGHTING

Explosion-Proof LIGHTING FIXTURES





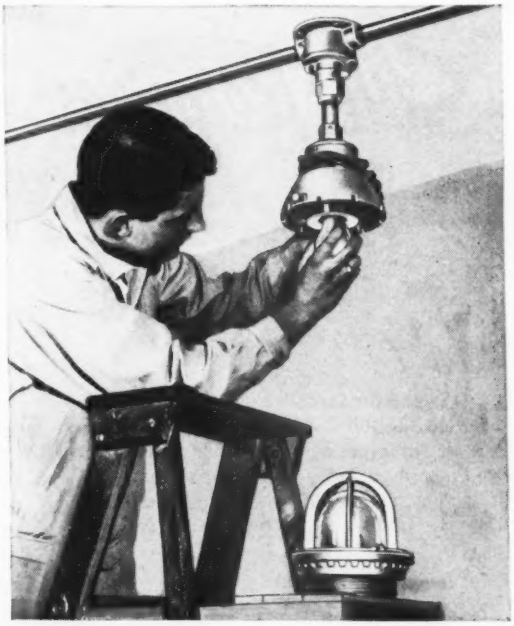
Easiest Relamping—3 Simple Steps

1. Single unit globe-holder assembly threaded into fixture hood is quickly removable for relamping. Slots are provided for prying with a screw-driver when necessary in corrosive atmospheres or other severe conditions. A large knurled thumb screw is easily loosened to unlock the globe and holder.

2. Globe and holder complete with guard (and reflector if used) is removed as an assembly. Only one lightweight piece to handle—globe retained in holder with flame-tight joint fully protected. Explosion-proof integrity assured. The 200/300-watt globe-holder assembly weighs but 8 lbs.

The new design of EV Explosion-Proof Lighting Fixtures is based on exhaustive studies and tests in Crouse-Hinds laboratories. The goal was to produce a fixture that would be easier to install and easier to relamp than any other explosion-proof fixture. Crouse-Hinds designers not only achieved this result but also created a fixture having the highest possible lighting efficiency.

You get 3-way savings when you install Crouse-Hinds EV Lighting Fixtures: quicker installation; quicker relamping; more light. This makes them the best buy for lighting in any location that is hazardous because of the possibility of the presence of flammable atmospheres. Use them on every job and have the best!



3. In relamping only a lamp is carried up and down the ladder and one assembly handled. It is not necessary to stock any spare parts or assemblies for complete convenience.

CROUSE-HINDS COMPANY
Syracuse 1, N.Y.

OFFICES: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver Detroit — Houston — Indianapolis — Kansas City — Los Angles — Milwaukee — Minneapolis New Orleans — New York — Philadelphia — Pittsburgh — Portland, Ore. — San Francisco — Seattle St. Louis — Tulsa — Washington. RESIDENT REPRESENTATIVES: Albany — Atlanta Baltimore — Charlotte — Corpus Christi — Richmond, Va. — Shreveport Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.

TRAFFIC SIGNALS · FLOODLIGHTS

INSTALLED 1939

Still Requires Practically No Maintenance!

This C-D capacitor installation has been on the job for an eastern utility since 1939. Its impressive record of "little or no maintenance required", year after year, confirms the time-tested dependability of the Cornell-Dubilier capacitor.

A talk with a C-D engineer can save you important maintenance dollars on your next power-factor installation. Cornell-Dubilier Electric Corp., Dept. D-23, South Plainfield, N. J.

CORNELL DUBILIER

WORLD'S LARGEST MANUFACTURER OF

CAPACITORS

PLANTS IN SO. PLAINFIELD, N.J. • NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS. • PROVIDENCE, R.I. • INDIANAPOLIS, IND. • FUQUAY SPRINGS, N.C. • SUBSIDIARY, RADIART CORP., CLEVELAND, O.

New OILTIGHT LIMIT SWITCHES

Here is a new line of remarkably compact Allen-Bradley limit switches . . . streamlined for fine appearance and built for millions of failure-free operations.

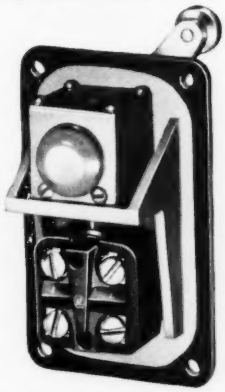
The operating heads of these limit switches may be attached to the switch body in four definite locations, each 90 degrees apart. A large selection of pushrods, lever arms, and other actuating mechanisms is available.

The name plate cover has a synthetic rubber gasket to exclude oil. Terminals are easily accessible by removing the cover plate. The body is threaded for ½" conduit. The switch mechanism is snap-acting, with one single pole normally open and one single pole normally closed contact, electrically separated.

The new Bulletin 802 limit switches are designed for machine tool applications. For further information send for a copy of Allen-Bradley Bulletin 802.

Bulletin 802 limit switch with roller lever

Roller lever type (Front View) for cavity mounting in machine frames



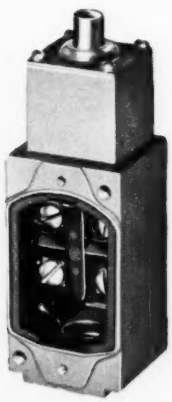
Roller lever type (Rear View) showing terminals for n.o. & n.c. contacts

ALLEN-BRADLEY
QUALITY
LIMIT SWITCHES

A-B Quality

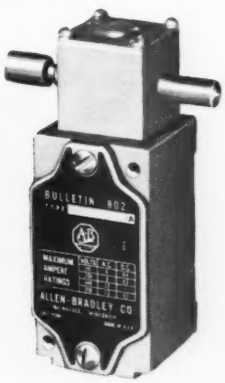
Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wisconsin

Pushrod limit switch with roller for vertical motion of the pushrod

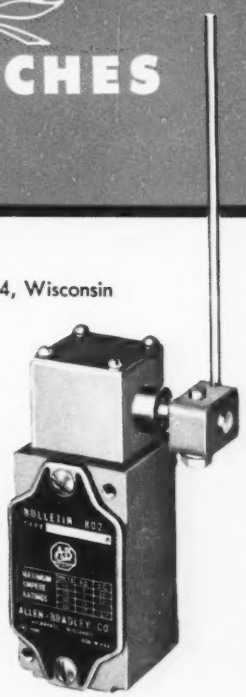


Pushrod limit switch without roller—cover off to show terminals

Pushrod limit switch designed for horizontal motion of the pushrod



Pushrod limit switch with side pushrod and maintained contacts

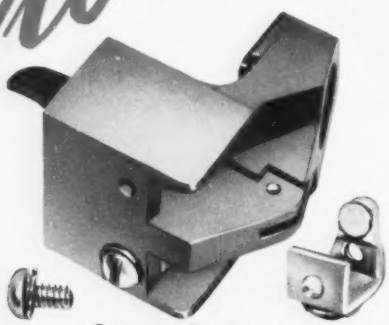


Lever operated limit switch with a long and flexible operating rod

1-53-MR

Extra! Handy Auxiliary Contacts

for all Allen-Bradley Sizes 0 and 1 Solenoid Controls



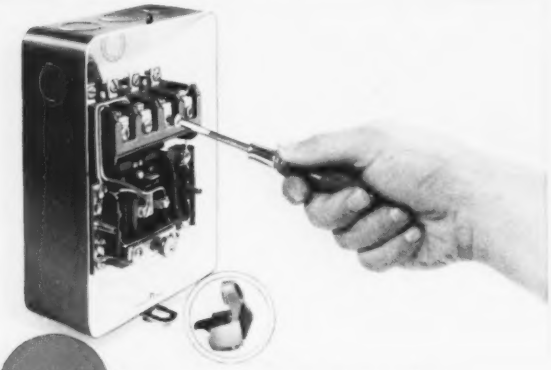
Contact may be reversed by removing one screw

Do you want to add one or more extra pilot contacts to some of your Allen-Bradley solenoid switches . . . to operate indicator lights, relays, or other starters?

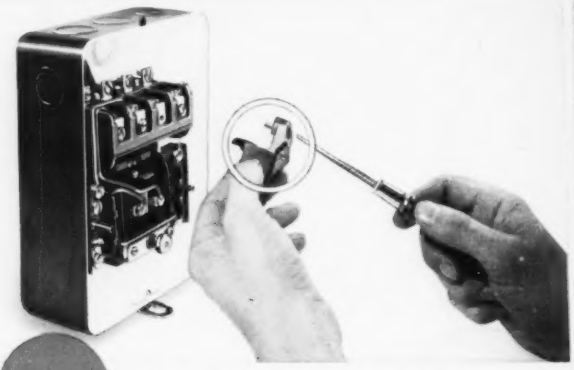
These new, compact auxiliary contacts can now be added to the arc hood of any and all standard sizes 0 and 1 solenoid switches. The operating arm of the auxiliary contact is actuated by the up and down motion of the solenoid plunger of the switch to which it is attached.

Write for descriptive literature.

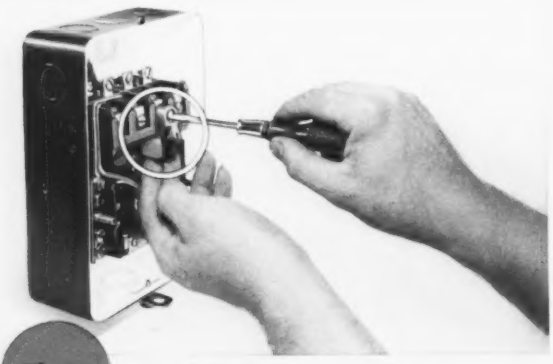
SO SIMPLY APPLIED



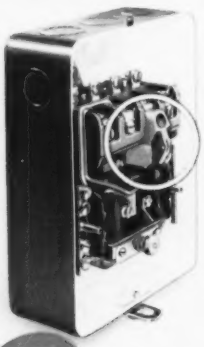
First Remove the terminal screw from the stationary contact block of the Allen-Bradley starter.



Second Insert terminal screw into mounting hole of auxiliary contact to be attached to starter.



Then Screw terminal screw into stationary contact block and fasten auxiliary contact to starter.



Auxiliary Contacts easily changed from n.o. to n.c. operation

The new Allen-Bradley auxiliary contact may be instantly changed from n.o. to n.c. contacts. Removal of one screw permits the instant reversal of the contacts in the contact block. There are no small parts to lose.

Ready to Wire Allen-Bradley auxiliary contact is now ready to be wired for any auxiliary pilot circuit.

1-53-MR

These auxiliary contacts are available for all Allen-Bradley sizes 0 and 1 controls, including contactors, reversing switches, combination starters, Bulletin 709 solenoid starters, and Bulletin 609 manual starters.

Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wisconsin

ALLEN-BRADLEY
QUALITY
SOLENOID CONTROLS

IH scores again...

NEW INTERNATIONAL TRUCKS

Proved as only IH can prove 'em

The 307 new features in the *New* International Trucks have been . . .

Proved in the world's most advanced truck Engineering Laboratory at Fort Wayne, Ind., **Proved again** on International Harvester's 4000-acre Arizona desert Proving Ground.

For profit-minded buyers. *New* International Trucks offer an unmatched combination of values—exactly the right truck for the job, unequalled performance, lowest maintenance and operating costs, maximum driver comfort.

Built the IH way. Choose from 168 basic models in America's most complete truck line. Each model embodies engineering principles, used in International's continuing program of truck research and development, that have resulted in hundreds of exclusive International features which have meant greater profits for truck buyers.

New International Trucks are BUILT as only IH can build them, PROVED as only IH can prove them, a VALUE only IH can give you.

Now—the features you want—in America's most complete truck line

New International styling identified by the IH emblem . . . **Exactly the right power** for every job. First truck builder to offer choice of gasoline or LP gas with Underwriters' Laboratories listing in 1½-ton sizes and other models . . . **Diesel power** optional in models rated 22,000 lbs. and over . . . **Designed by drivers for drivers**—Comfo-Vision cab with one-piece Sweepsight windshield. New comfort and interior styling . . . **Steel-flex frames** proved best in the field . . . **Transmissions** to meet any operating requirement . . . **296 Wheelbases** ranging from 102 inches up . . . **Easy starting and greater fuel economy . . . Wide range** of axle ratios for all models . . . **Real steering comfort and control.** Sizes from ½-ton to 90,000 lbs., GVW rating. Now—See The New IH-Built, IH-Proved Internationals at your nearest International Dealer or Branch.

INTERNATIONAL HARVESTER COMPANY • CHICAGO

International Harvester Builds McCormick Farm Equipment and Farmall Tractors . . . Motor Trucks . . . Industrial Power . . . Refrigerators and Freezers

Better roads mean a better America

INTERNATIONAL TRUCKS

"Standard of the Highway"

Twins?

No!

It would be easy to persuade almost anyone that these two pieces of strand are identical twins. If you go by their looks, you can't tell one from the other. Yet actually, they're as different as high noon and midnight.

One is conventional strand, and when you cut it, the wire ends are going to spring apart—yes, spring apart—because of internal tension. To beat this, you have to seize before cutting.

The other piece is Bethlehem Form-Set strand, the preformed kind. This you can cut, and absolutely nothing happens. All the wires lie calmly in place. No springing apart; no "bushing out." Hence, no seizing needed. After the cut, the ends are clean and smooth—ends that go into a fitting as easily as a rigid rod.

That's what preforming does for a strand. It gives the wires a permanent curl that largely nullifies internal tension. Thus the wires aren't all "keyed up"; they have no urge to fly apart when a cut is made.

This is a Form-Set advantage that appeals to every lineman. There isn't any handling problem—none at all—when the lineman slides those neat, trim ends into his fittings.

All five grades of Bethlehem strand (common, siemens-martin, high-strength, extra-high-strength, and utilities) can be obtained with the Form-Set feature. And all five grades are protected by the rust-resisting bethanized coating, which doesn't peel or crack, even under repeated bending.

Sound pretty good? Order a reel and check for yourself.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

NOW do they look like twins?

The bushy specimen isn't a preformed strand. A tough customer, unless you seize it before cutting. But look at the Form-Set strand—the one with the clean-cut end. No seizing required at all!

Bethlehem *FORM-SET* Strand

BETHLEHEM STEEL

20 New Stocking Points —
SPEED DELIVERY OF 5/8% STEP VOLTAGE REGULATORS

ALLIS-CHALMERS
5/8% STEP VOLTAGE REGULATORS

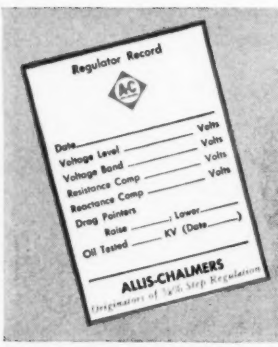
Now Allis-Chalmers power and distribution regulators are stocked in 20 convenient stocking points across the country. You can solve voltage problems faster than ever before. You can eliminate complaints due to low voltage at once. Best of all, you can start profit curves rising as soon as investigation shows that low voltage is the cause.

Get Field-Proved Regulators

Allis-Chalmers 5/8% step voltage regulators have proved their economy and reliability in over twenty years of operation.

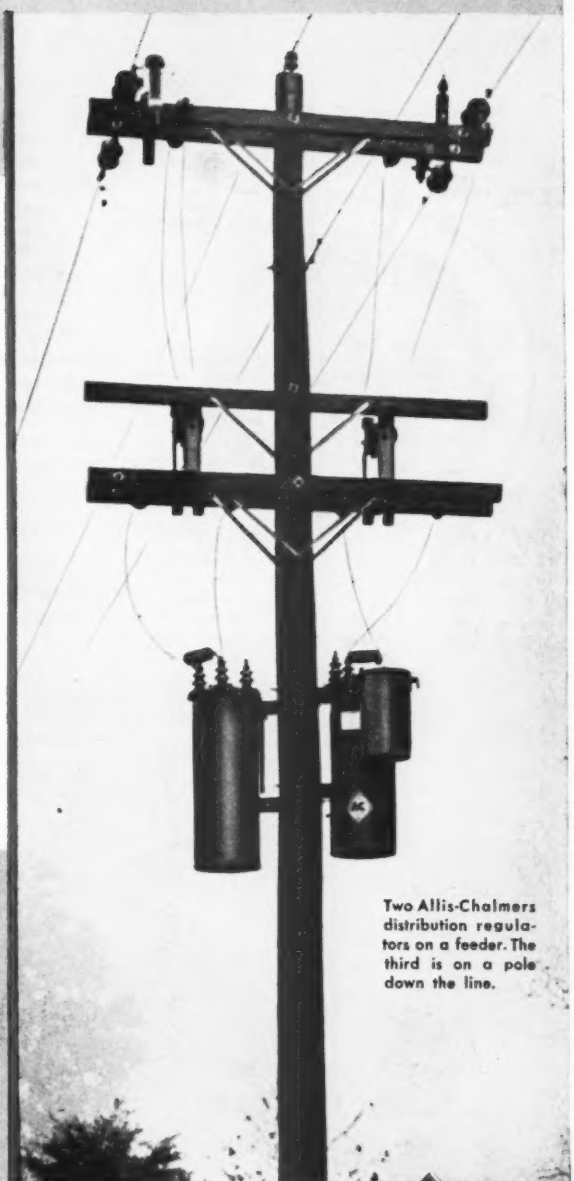
Call your nearest Allis-Chalmers district office for the complete story or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3932



FREE
Maintenance Stickers

You can keep a handy, on-the-spot record of control settings with these adhesive-backed stickers. They provide a convenient service record for all types of regulators. Write on them either with pen or pencil.



Two Allis-Chalmers distribution regulators on a feeder. The third is on a pole down the line.

ALLIS-CHALMERS

Originators of 5/8% Step Regulation

Exide-Manchex
BATTERIES
USED BY P.G.&E.

At this great Moss Landing plant of the Pacific Gas and Electric Company, five huge turbo-generators, with a rated capacity of 575,000 K.W., are now in operation. During 1953 this capacity will be doubled, making it one of the nation's largest producers of electric power. Through the company's vast interconnected system, power from this station can be transmitted to other areas as needed.

All control power for operation of circuit breakers and for carrying the emergency lighting load, is supplied by Exide-Manchex, the dependable battery which assures:

POSITIVE OPERATION: Dependable performance at ample voltage with no switchgear failures.

INSTANTANEOUS POWER: High rates for switchgear operation with adequate reserve power for all other control circuits and for emergency lighting.

LOW OPERATING COST: Extremely low internal resistance.

LOW MAINTENANCE COSTS: Water required about twice a year. No change of chemical solution during life of battery.

LOW DEPRECIATION: Sturdy, long-life construction.

GREATER CAPACITY in a given amount of space avoids overcrowding.

• • •

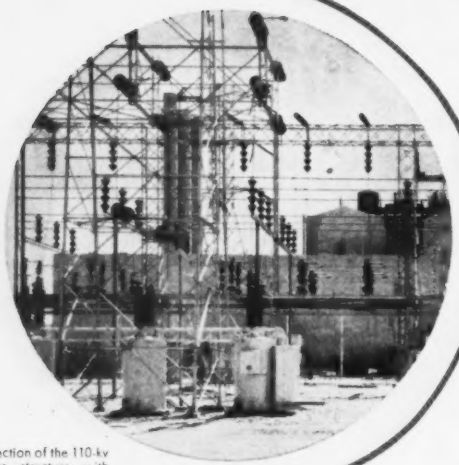
Various sizes and types of Exide Batteries, up to 100 ampere hours capacity, are available in plastic containers.

Exide-Manchex is your best battery buy for all control and substation services.

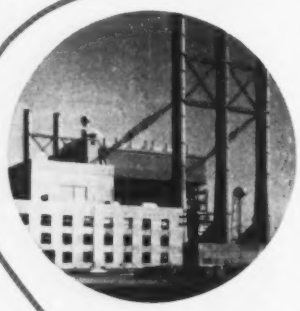
THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 2
Exide Batteries of Canada, Limited, Toronto

1888...DEPENDABLE BATTERIES FOR 65 YEARS...1953

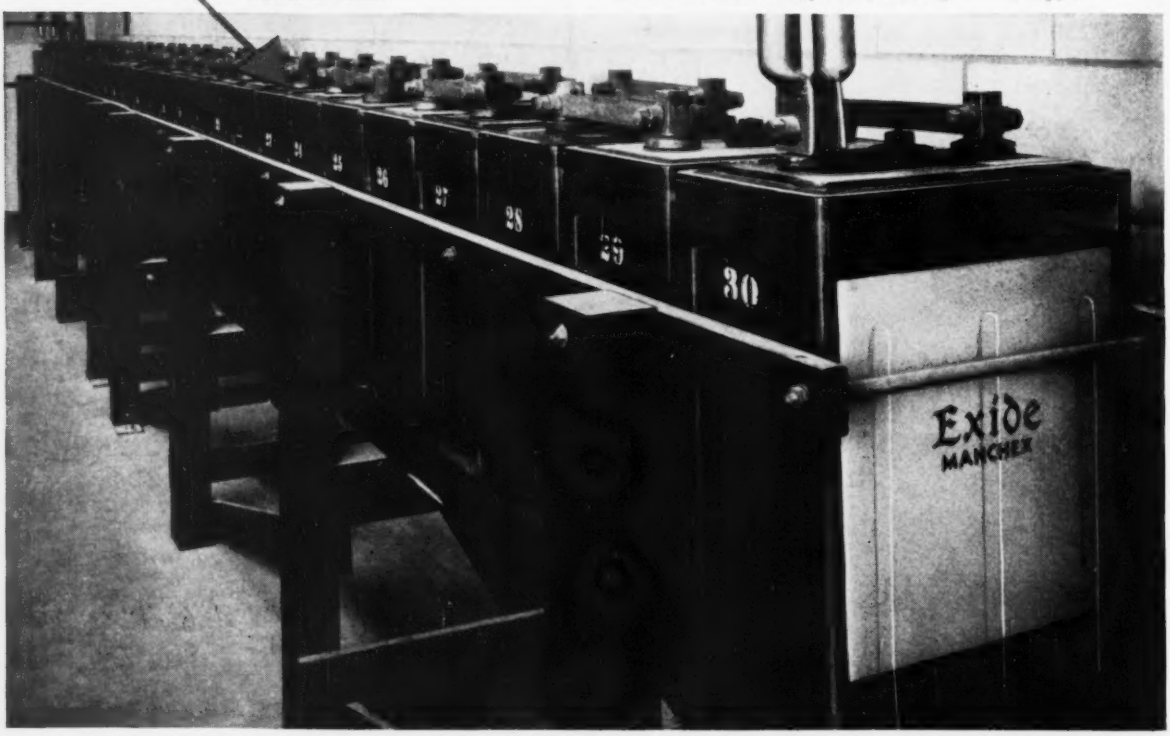
"Exide" and "Manchex" *Reg. T.M. U.S. Pat. Off.*



Section of the 110-kv bus structure with main turbine building in background.



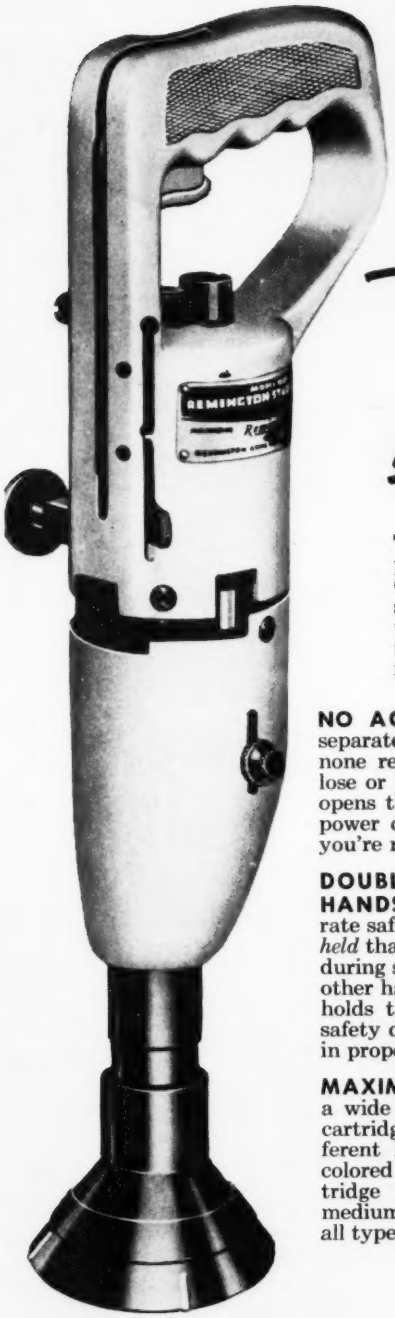
Moss Landing Steam Plant of Pacific Gas & Electric Company. Stone & Webster Engineering Corporation, engineers and builders.



One-half of installation of 60-cell FME Exide-Manchex battery in Moss Landing plant.

MODEL 450 REMINGTON STUD DRIVER

—the ONLY powder-actuated fastening tool with ALL these advantages—



The Model 450 Remington Stud Driver sets up to 5 fastening studs per minute—a speed unmatched by other powder-actuated tools. Completely self-powered, this amazing tool fastens steel or wood structural pieces to concrete or steel surfaces in seconds. Its light weight—only 5½ pounds—makes it ideal for use overhead or in confined spaces. Check these other *exclusive* Remington Stud Driver features:

NO ACCESSORIES REQUIRED. No separate parts needed to control power, none required for loading—nothing to lose or break. Just a twist of the wrist opens the Model 450. Insert stud and power cartridge as a unit...close and you're ready! Whole job takes seconds.

DOUBLE-SAFE—REQUIRES *BOTH* HANDS FOR OPERATION. A separate safety lever must be depressed and *held* that way with one hand before and during squeezing of the trigger with the other hand. Safe, two-handed operation holds the tool steady. Two *additional* safety devices prevent operation except in proper fastening position.

MAXIMUM POWER RANGE. You get a wide choice of power in Remington cartridges. They're available in six different loads, each clearly marked by colored heel caps. The 32 caliber cartridge gives you extra power in this medium-duty tool . . . helps you speed all types of fastening jobs.

ARROW-STRAIGHT DRIVING—PERFECT GAS SEAL. Long heel cap on all Remington cartridges provides perfect gas seal . . . gives the Model 450 more power. Assures controlled, consistently straight driving.

FAST, POSITIVE EJECTION. Exclusive ejector snaps fired case out of tool instantly—no fumbling, no tools needed.

* * *

Test-proved to be the world's finest and speediest fastening system, the Model 450 Remington Stud Driver is made by Remington Arms Company, Inc., *America's oldest sporting arms manufacturer.*

NEW, FREE BOOKLET shows you a hundred different ways the Model 450 Remington Stud Driver can speed *your* construction fastening. Packed with illustrations, it tells you where and how this tool can save time, reduce fatigue and cut costs. Send in the coupon below for your copy.

Listed & Approved by Underwriters' Laboratories, Inc.

"If It's Remington—It's Right!"

Remington

DUPONT

MAIL THIS COUPON TODAY

Industrial Sales Division, Dept. EW-2
Remington Arms Company, Inc.
939 Barnum Ave., Bridgeport 2, Connecticut

Please send me my *free* copy of the new booklet showing how I can cut my fastening costs.

*Name*_____

*Position*_____

*Firm*_____

*Address*_____

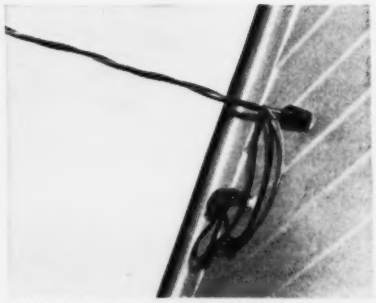
*City*_____ *State*_____

THERE'S A DIFFERENCE

when you specify aluminum conductor

IMMEDIATE SAVINGS—Aluminum conductor gives you *immediate* savings. Initial cost far less than copper. Easier handling because of aluminum's lighter weight.

INSTALLATION SAVINGS—Aluminum's lightness helps insure faster installations. Linemen find it easier to string, handle, move around. Saves time and money.



MAINTENANCE SAVINGS—Aluminum's lightness assures lower tensions on house, pole. Minimum maintenance required on lines and services. Potential *total* savings with aluminum conductor—up to 25%.

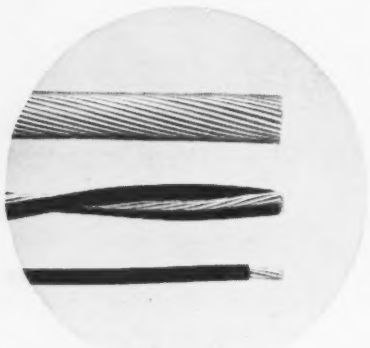
THERE'S A BIG DIFFERENCE

when you specify Kaiser Aluminum conductor

FIELD SERVICE—Experienced Kaiser Aluminum field men work hand in hand with crews on stringing operations, often devise money-saving techniques. They continually check installation schedules—one big reason why Kaiser Aluminum's record for *on-time delivery* is unsurpassed!

ENGINEERING AND LABORATORY SERVICE—Kaiser Aluminum engineers suggest methods to improve quality, cut costs. They make full use of top-notch Kaiser Aluminum laboratories, call in specialists for organizational meetings, furnish sag and tension charts.

CONVENIENT DISTRIBUTOR SERVICE—Kaiser Aluminum conductor distributor offices are located nearby you, wherever you are. They stock a wide range of Kaiser Aluminum conductor—offer quick service and helpful technical assistance.



THIS COMPLETE SERVICE is available to you at no obligation when you specify Kaiser Aluminum conductor. *Act now!* A letter or telephone call is all that's required. Also request free pamphlet giving complete engineering data on new Kaiser Aluminum covered conductor—both weatherproof line wire and self-supporting Triplex cable for service drops and secondary distribution lines.

Contact any Kaiser Aluminum office in principal cities, or one of our many distributors. Kaiser Aluminum & Chemical Sales, Inc., Oakland 12, California.

Kaiser Aluminum

Setting the pace . . . in growth, quality and service

NEOPRENE AND POLYETHYLENE COVERED CONDUCTOR, SOLID AND STRANDED • SELF-SUPPORTING TRIPLEX CABLE • ACSR • ALL ALUMINUM CONDUCTOR

VOLTAGE IMPROVEMENT obtained with switched capacitors is discussed by F. M. Reed, (right), System Planning Engineer for Pennsylvania Electric, and A. M. Dawson, G-E Sales Representative. Blackboard diagram summarizes effect of capacitors on system regulation.

G-E switched capacitors help regulate voltage on Penelec's whole system

120,000 kvar of capacitors give system-wide voltage-boost, release kilowatt capacity—reduce system investment.

To complement its generator bus regulation, the Pennsylvania Electric Company of Johnstown, Pa. has installed 120,000 kvar of switched capacitors. Within the next year, this will be increased to 150,000 kvar or 1 kvar for every 3.64 kw of its estimated 1953 peak load of 546,000 kw.

The automatically controlled capacitors assure adequate local generation of kilovars and provide a needed voltage boost on distribution circuits. But they do more than this.

By relieving transformer, transmission, and generating facilities of reactive load, the capacitors reduce voltage drop and improve voltage regulation throughout the entire system—as much as 20% at full load at the distribution level.

This permits the Penelec system to carry more kilowatts within the limits of good regulation. And since the cost of capacitors needed to release capacity is less than the cost of new capacity, the system investment per kilowatt is reduced.

G-E automatically switched capacitors may prove economical on your system, too—for improving voltage, releasing capacity, reducing losses, and keeping system investment down. For more information, get in touch with your local G-E Apparatus Sales Office. General Electric Company, Schenectady 5, New York. 441-1

58,000 KVAR of switched capacitors at Penelec's substations use current compensated voltage control to provide bulk kilovars, improve regulation when load is heavy. An additional 62,000 kvar of switched capacitors are installed out on feeders. Units boost voltage, reduce losses by an estimated 8%.

GENERAL ELECTRIC

Kuhlman gives you

NEMA standards plus...

59 years experience building sturdy, reliable transformers

You can get a transformer that conforms to NEMA Standard almost anywhere. Transformer manufacturers conform to these standards, but you get certain "plus values" when you use Kuhlman power transformers. For instance, the Kuhlman Electric Company has been building transformers since 1894, shortly after the very first transformer was installed at Great Barrington, Massachusetts.

And for 59 years Kuhlman has been designing and building transformers to meet the requirements of utility and industrial users.

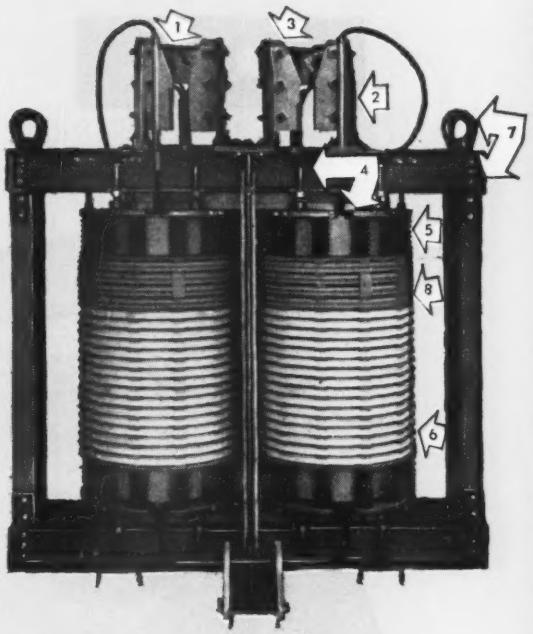
That's a lot of experience. It has resulted in power transformers that not only conform to the minimum NEMA requirements, but which have a high reputation for efficiency, reliability, and functional simplicity. Kuhlman engineers overlook no details in designing and building power transformers which will give you many years of efficient, dependable service. It is chiefly because of Kuhlman's use of approved and accepted design principles, carefully selected and tested materials, painstaking assembly, and thorough testing and inspection that you get a transformer of rigid, sturdy construction — the "plus value" which is the result of 59 years' experience.

The structural steel core clamps, which secure the core-and-coil assembly and anchor it to the tank, are the main source of sturdiness in Kuhlman power transformers.

Lock spacers, inserted between the coil sections, increase the strength of the coil and add to the over-all sturdiness of the transformer.

The tank is made from heavy steel plate. All cooling tubes and seams are electrically welded, providing oil-tight and rust-proof joints. The surfaces are shot-blasted and covered with a rust-inhibitive primer and two coats of corrosion-resistant paint.

Specify Kuhlman for your next transformer installation. Write us for the name of your nearest Kuhlman representative. And for further details about Kuhlman power transformers, ask for Bulletin CS-601.



CONSTRUCTION DETAILS

1. Tap changer board — made of special heat resistant material developed by Kuhlman. Won't crack under high Class A insulation temperature.
2. Terminal board supports — made of grade A press board.
3. Fibre bolts — combine high electrical and mechanical strength.
4. Clamp jack screws and steel clamping plates — supply easily adjustable coil pressure top and bottom.
5. Porcelain blocking posts — offer increased creepage strength.
6. Lock spacers — firmly anchored between coil sections add to over-all construction strength.
7. Rigid core clamps with lifting lugs — provide mechanical strength and ease of handling.
8. Reinforced end coils — protect the transformer from surge potentials.

Kuhlman

ELECTRIC COMPANY
BAY CITY, MICHIGAN
CRYSTAL SPRINGS, MISSISSIPPI

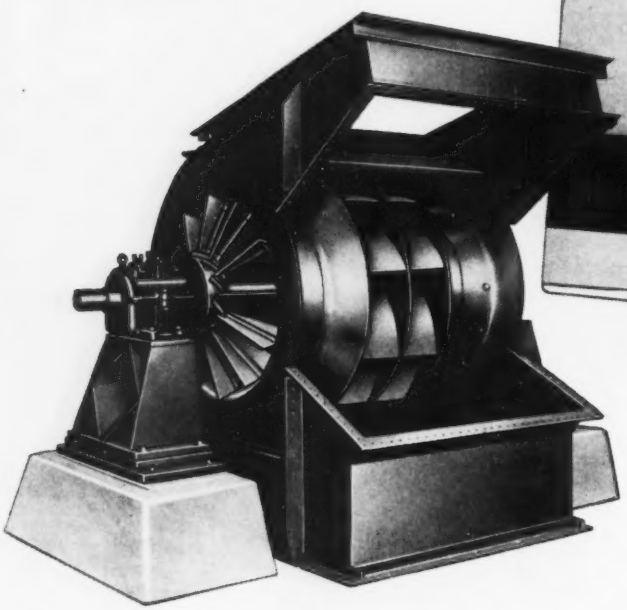
Export Representatives: *International Standard Electric Corporation,* 50 Church Street, 15th Floor, New York 4, New York
Cable address: Microphone, N. Y.

EVALUATE

THE NEW WESTINGHOUSE

AIRFOIL

CENTRIFUGAL FAN



Recently the Sturtevant Division of Westinghouse introduced another major advance in fan design—the new Airfoil-Bladed Centrifugal Fan. Now, just off the press, is a new catalog describing it in full detail.

Sturtevant's scientific application of Airfoil Blading has produced a new high in efficiency and a new low in noise level. Result:

Peak Efficiency .....90% *plus*
Noise Intensity .....65% *less*

Wherever a lower operating cost means more than first cost—where evaluation and a reasonable price mean more than a low price—the Westinghouse Airfoil, Non-Overloading Fan is the answer.

Get your free copy of Catalog 1320 today. Contact your nearest Westinghouse-Sturtevant office, or write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

Airfoil Fans Installed or to be Installed at:

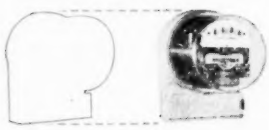
Consolidated Edison—Astoria
Consolidated Edison—East River
Duke Power Company—Buck
New York State Electric & Gas Corp.—Greenidge
Pennsylvania Electric Company—Shawville
Tennessee Valley Authority—Kingston-Colbert
Hartford Electric Company—Laurel
Southern California Edison—Redondo
Tucson Gas & Electric Company—Station #3
Gulf States Utilities—Nelson
Squirrel Hill Vehicular Tunnel—Pittsburgh
Kaiser Manufacturing Co.—Detroit

YOU CAN BE SURE...IF IT'S **Westinghouse**

STURTEVANT DIVISION

J-80268

All Sangamo Polyphase Meters come in small packages!



Because of their single disk construction, *all* Sangamo Polyphase Meters, whether 2, 2½, or 3 element, come in the smaller sizes required of modern power meters. This saves installation time and expense. For example, on change-overs to 4-wire network systems, the Sangamo LC-3 Element Meter will fit in exactly the same space as the delta 2 element meter which it replaces.

Besides the smaller size and lighter weight, the use of but a single disk also increases bearing life, lessens the effect from friction on light loads, and provides stability of calibration.

Too, there is the convenience of all adjustments, including the micrometer adjustments for full load, light load, inductive load, and element balance, being readily accessible—with just a screwdriver—enabling easy testing on the premises.

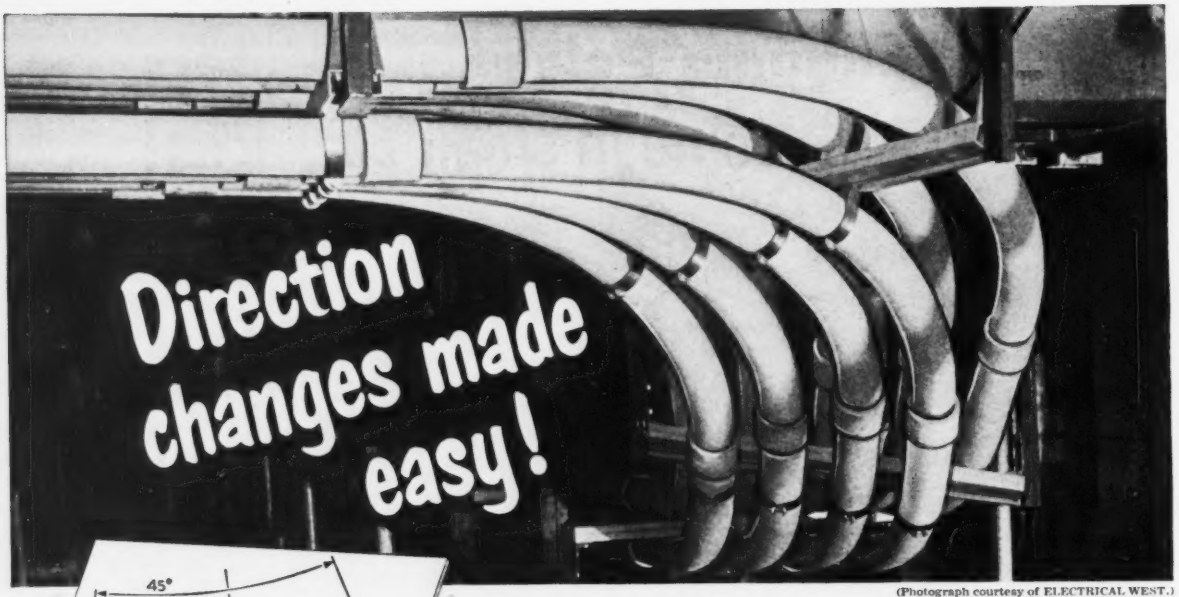
And if it should be necessary to install your polyphase meters in locations of extreme exposure to corrosive industrial or salt atmospheres, you can now expect much longer meter life because of the new corrosion-resistant finishes with which all Sangamo Meters are treated.

For more detailed information on Sangamo Polyphase Meters ask your Sangamo Representative.

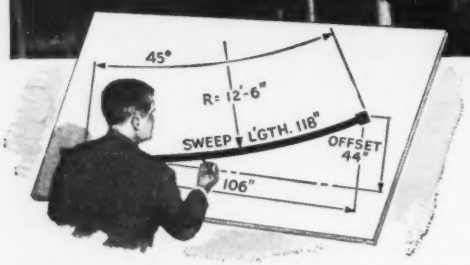
SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

Only Measured Facts are Known Facts

SM53-1



(Photograph courtesy of ELECTRICAL WEST.)



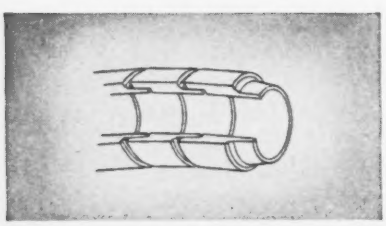
. . . with standard fittings for TRANSITE asbestos-cement DUCTS

When you use Transite Ducts, you have available a wide variety of standard fittings, made of the same asbestos-cement material as the ducts themselves. These fittings save time and expense because they provide maximum flexibility in laying out or constructing a duct system. They facilitate clearing unexpected obstructions or accommodating revisions in the original layout.

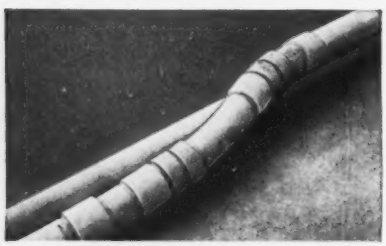
For instance, the new Transite 5° Bend Segments (shown at left) can be used alone to form simple and complex curvatures of any multiple of 5°. Used with other standard Transite curved fittings, they form curvatures of odd degrees. Thus, they enable you to simplify cross-overs and transformations . . . to clear obstructions . . . to form unusual or special bend or offset sections. They eliminate the need for purchasing special radii bends or sweeps.

The other standard Transite fittings that facilitate directional changes are the offset bends, standard 45° and 90° bends, sweeps, curved segments, laterals, tees, elbows and deflection couplings. These fittings are machined to a standard taper so that they can be used with Transite Conduit, Transite Korduct or with other Transite fittings.

For more information, write Johns-Manville, Box 60, New York 16, N. Y. In Canada, address 199 Bay Street, Toronto 1, Ontario.



5° bend segment sketched in detail. It consists of a straight section of Transite stock with a male taper on one end and a female taper on the other . . . each machined at an angle of 2½° to the center axis. Segments can thus be used single, or combined to form bend sections whose curvature is any multiple of 5°.



Photograph showing use of bend segments and curved segments with Transite Ducts.

5 OTHER REASONS WHY TRANSITE DUCTS DO A BETTER JOB AT LESS COST:

1. Corrosion-Resistant. Transite, being made of inorganic asbestos and cement, resists corrosion and is immune to electrolysis.

2. Permanently Smooth Bore. Transite makes long cable pulls easy, under any conditions. Danger of damage to cables is also minimized.

3. Incombustible. Transite will not burn or contribute to formation of smoke, gases, fumes. It confines burnouts, will not soften under heat.

4. Higher Thermal Conductivity. Cables run cooler in Transite, reducing I^2R losses, increasing current capacity and prolonging insulation life.

5. Easy to Install. Transite Ducts are light weight, easy to handle. Joints are quickly made. Long 10-foot lengths reduce number of joints in line.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE® DUCTS

TRANSITE KORDUCT—for installation in concrete

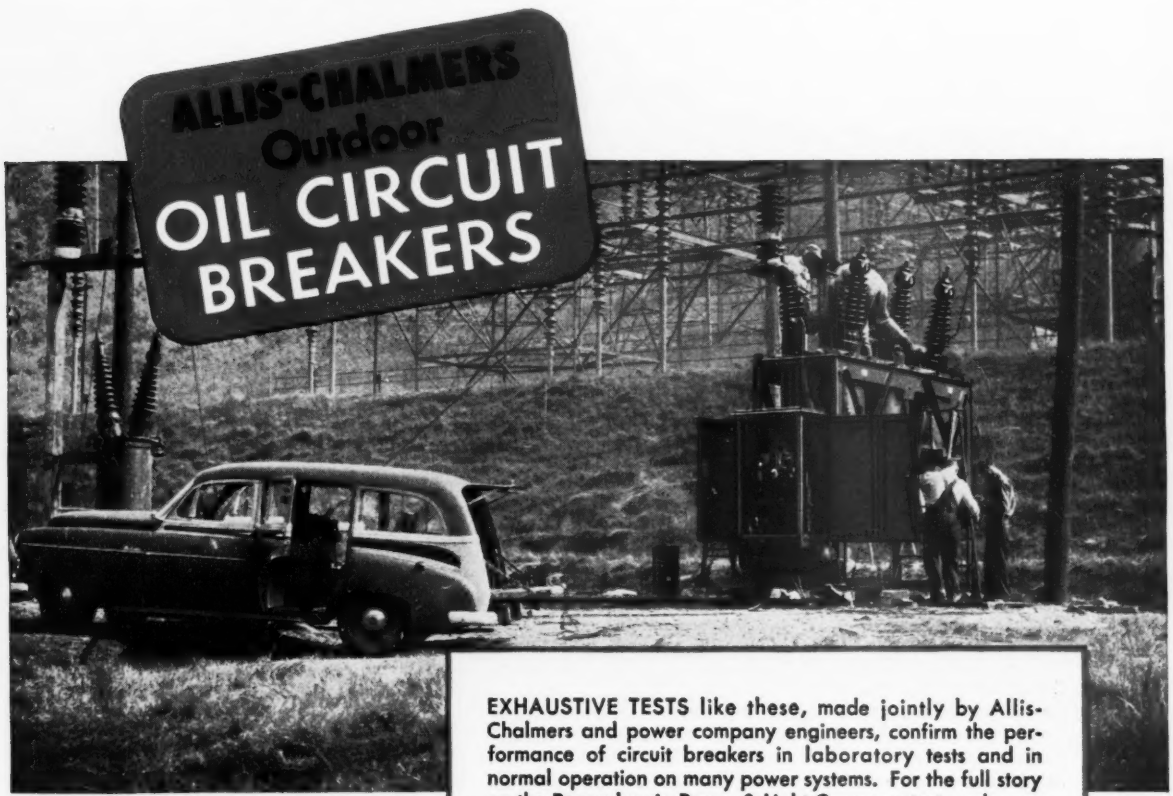
TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

HOW MUCH Can a Breaker Take?

Here's the Answer Provided by Field Tests on Pennsylvania Power & Light Company System

In a single test series, a standard Allis-Chalmers 69-kv breaker provided Pennsylvania Power & Light Company engineers with positive proof of its ability to:

1. Interrupt a total kva power of approximately *18 times* its interrupting rating — *with no maintenance or adjustment* during the test period.
2. Include, in the total, *eleven* fault interruptions at or above full breaker rating.
3. Pass a group of line-charging and discharging tests *without a restrike.*
4. Show, on inspection after test, that more service could safely be expected.



Standard production-line FZO-151-69F breaker was used for these field tests.

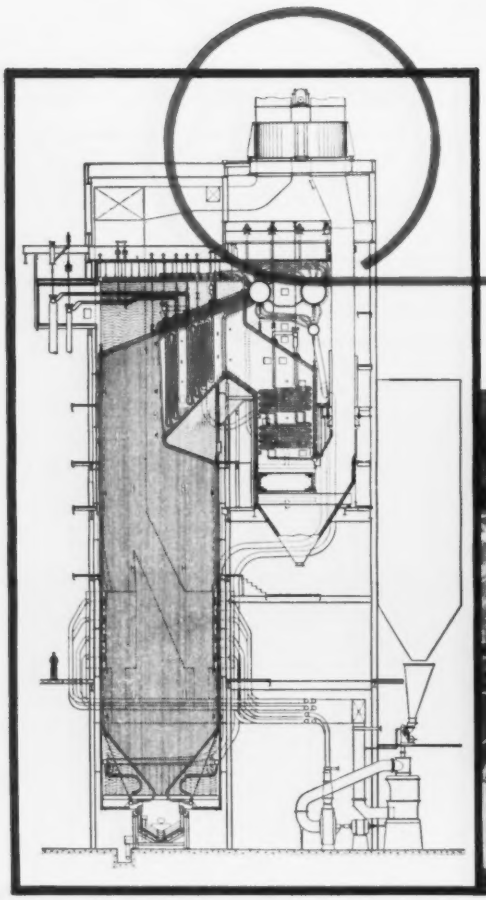
EXHAUSTIVE TESTS like these, made jointly by Allis-Chalmers and power company engineers, confirm the performance of circuit breakers in laboratory tests and in normal operation on many power systems. For the full story on the Pennsylvania Power & Light Company tests, ask your A-C representative for Bulletin 71R7855, or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3791

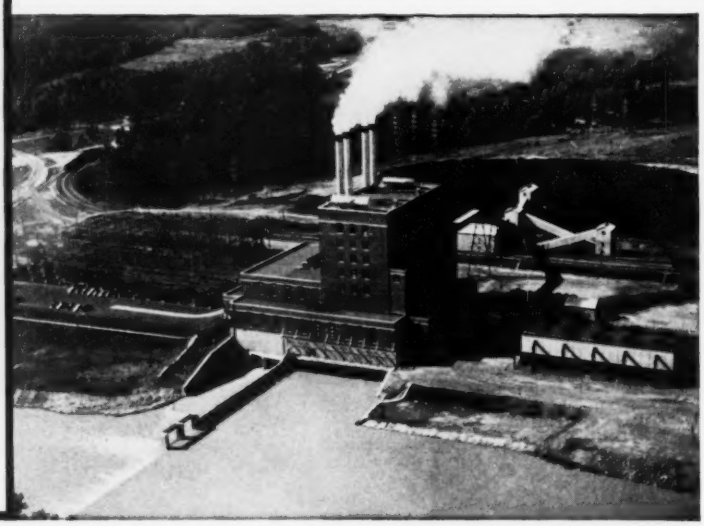
ALLIS-CHALMERS

All Reheat Boilers at New Lee Station of the Duke Power Company

equipped with

LJUNGSTROM AIR PREHEATERS





By mid-summer last year, both units of the first section of the Duke Power Company's new Lee Station had gone into service. Designed and built by Duke Power's own organization, Lee Station's 190,000 kilowatts help fill the growing power needs of industrialized South Carolina..

Each of the station's two 90,000/100,000-kw turbine-generators is powered by a boiler designed and built by Combustion Engineering–Superheater, Inc. These C-E Steam Generating Units are fired by pulverized coal, and furnish steam at a throttle pressure of 1250 psi and 950 F, reheated to 950 F.

Two Ljungstrom Air Preheaters are used with each boiler. These Ljungstroms preheat combustion air to 620 F and cool exit gases to 310 F.

Lee Station is another example of the unanimity with which the Ljungstrom Air Preheater is accepted as a standard unit for high-efficiency steam generators. Since the war, Ljungstrom Air Preheaters have been specified for an hourly capacity of over 285,000,000 pounds of steam.

THE Air Preheater Corporation 60 East 42nd St., New York 17, N. Y.

ARTERIES FOR ELECTRICITY—THE *Heart-Beat* OF AMERICA!

For over 35 years, TRIANGLE CONDUIT & CABLE CO., INC., has provided, through its nation wide network of distributors, the arteries for electrical systems—for industry, business and the home.

When you use electricity—to make the wheels of your plant go around, to run your elevators or light your reading lamp, there's a good chance it travels through Triangle wire, cable or conduit.

What do YOU need? Feeder cables or circuit wires for industry • special cables: parkway • power • varnished cambric • underground • aerial • wire for residential work • raceway systems: hot-dip galvanized rigid conduit, thin-wall conduit, flexible steel conduit • we produce all these and many others • every day • toward *building* a better America. We invite you to call on your electrical distributor handling Triangle Products. There's one very near you—and at your service!

The Trade Mark of Top Quality

TRIANGLE

It Must Be Right

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, NEW JERSEY

When it's a Question of Carrying Electrical Power—Specify TRIANGLE

NEW! SIMPLIFIED! SMALLER!

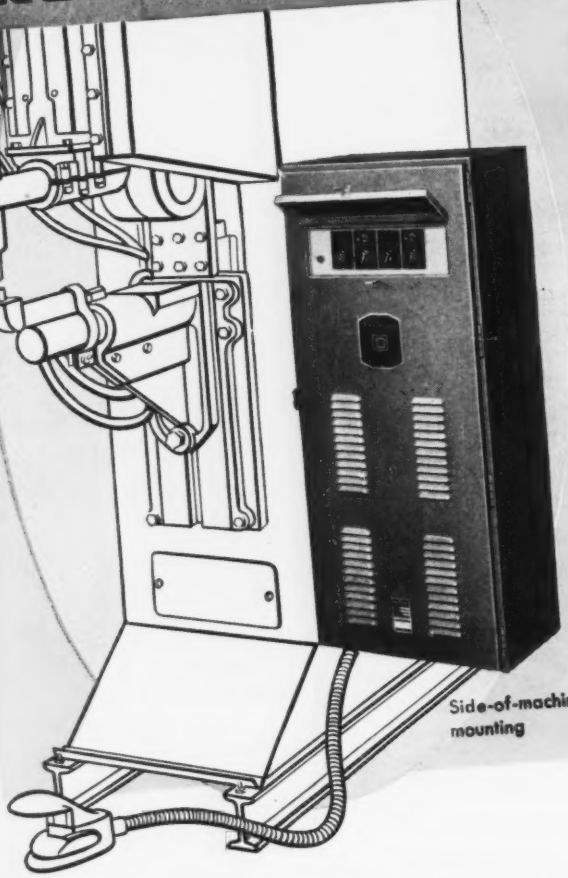
ELECTRONIC NON-SYNCHRONOUS WELDER CONTROL

Here is design simplification that affords significant advantages—easy installation, less maintenance, smaller size, mounting versatility.

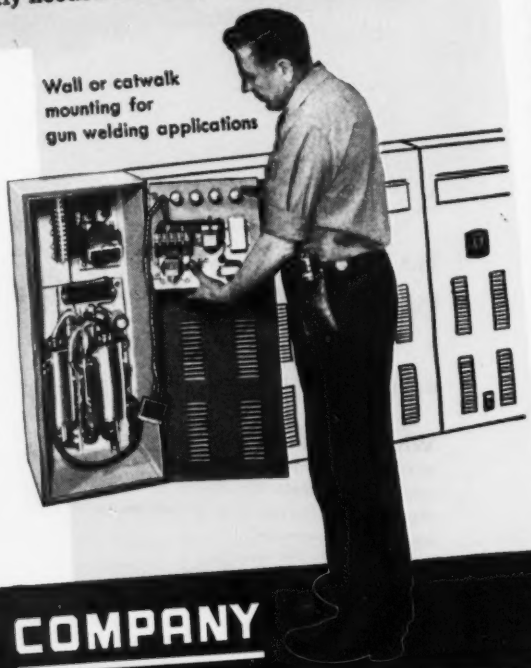
Drastically simplified NEMA 3B weld and sequence timing circuit requires only 4 tubes plus valve relay and firing relay. Extreme consistency and timing accuracy are maintained. All tube circuits are "fail-safe." Firing of power tubes is synchronized to minimize transients and ease stress on welding transformer.

Interchangeable NEMA 3B and 5B timer panels are quickly detached from door. Plug-connectors to power pack in cabinet permit easy replacement.

Much smaller in size, this new controller (15" x 15" x 37") requires little more space than formerly needed for the ignitron contactor alone.



Side-of-machine mounting



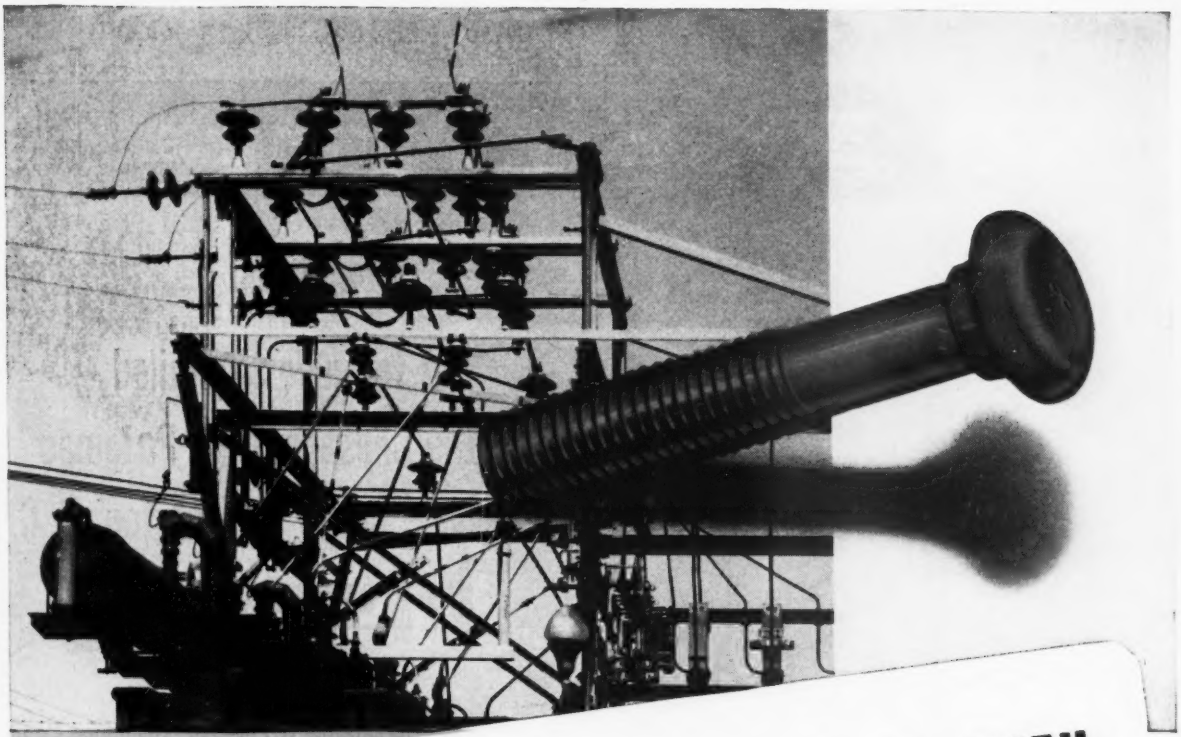
Wall or catwalk mounting for gun welding applications

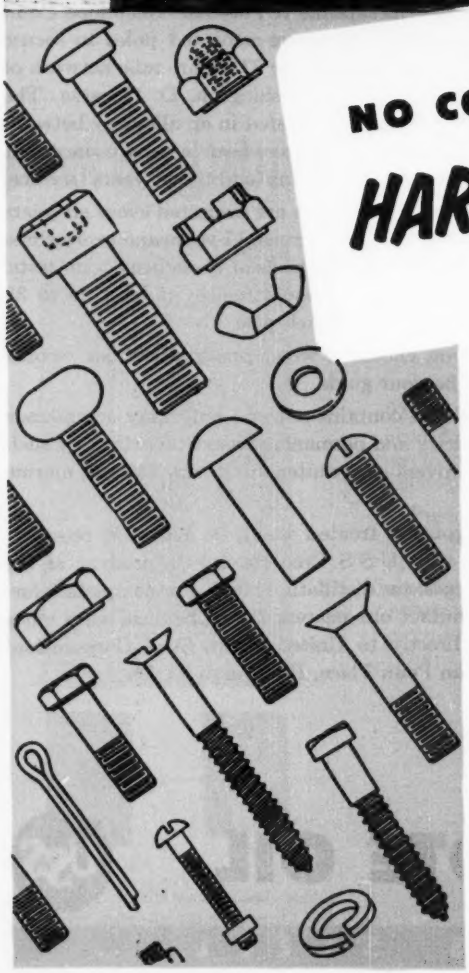
Wall or Machine Mounting without Extra Work

• Enclosure design permits wall or side-of-machine mounting with the same controller and without the additional trouble of relocating adjuster dial assembly. Installation is made easier by generous wiring space below contactor, and vertical wiring channel extending the full height of the cabinet. All components are arranged for maximum accessibility.

Write for Bulletin 8992 **on Electronic Non-Synchronous Welder Control and its application to spot and projection welders. Address Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin.**

SQUARE D COMPANY





NO CORROSION PROBLEM WITH

HARPER CONNECTOR BOLTS

Harper Pan Head Connector Bolts by the thousands are serving on electrical connectors in power transmission equipment. These bolts of silicon bronze are constantly subjected to extreme conditions of corrosion and stress. They typify the quality engineering and metallurgy that are important factors in all Harper fastenings.

Harper Connector Bolts are an example, too, of special fastenings that have been engineered by Harper, standardized, and are now carried in stock for a special industry.

In the Harper line of fastenings carried in stock are more than 7000 items. All types of fastenings of non-ferrous metals and stainless steel are available from Harper. Call the Harper Distributor nearest you or write for information.

The H. M. Harper Company
8205 Lehigh Ave., Morton Grove, Ill.

BOLTS • NUTS • SCREWS • RIVETS
STUDS • WASHERS
of
BRASS • NAVAL BRONZE • SILICON
BRONZE • MONEL • NICKEL • ALUMINUM
and ALL STAINLESS STEELS

HARPER

EVERLASTING FASTENINGS

Specialists in all non-corrosive metals

Here's Proof of Performance...

Over 99% of the poles installed by the Chesapeake & Potomac Telephone Co. in Washington, D. C. are Pressure-Creosoted

IN 1930 the Chesapeake & Potomac Telephone Company turned to pressure-creosoted poles to secure longest possible life for their 67 square mile network of telephone poles in the Washington, D. C., area. The three poles shown here, located in an alleyway between 16th and 17th Sts., S. E., have been in service since that time and are good for many additional years' service.

Pressure-creosoted poles are inspected every six years until they have been in service 17 years and every three years thereafter. On the basis of these inspection tests, the Company feels it should realize at least 30 to 35 years of service out of each pole.

When you choose a wood preservative, let records like these be your guide.

Creosote Oil contains not one but many compounds whose toxicity and permanence ward off attack by such wood destroyers as termites, fungi, dry rot and marine borers.

When you use treated wood, be sure it is pressure-creosoted with U·S·S Creosote Oil—a product of the world's largest tar distillation plant. For complete information, contact our nearest Coal Chemical sales office or write directly to United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

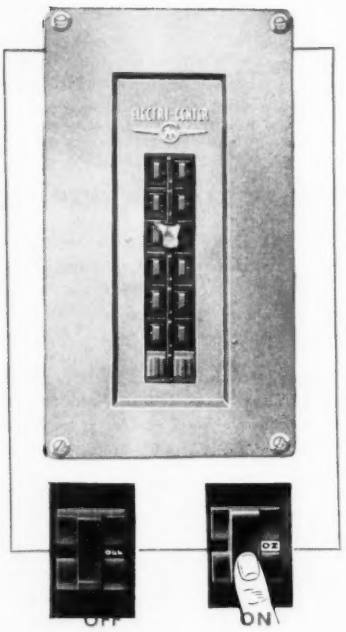
U·S·S CREOSOTE OIL

USS

2-1687

UNITED STATES STEEL

Thoroughbred in home electrical equipment



When short circuits or overloads strike, Pushmatic instantly stops current. Just *push the button* and service is restored (unless trouble still exists).

Pushmatic Electri-Centers... for home protection at its finest

The famous BullDog trademark on electrical equipment means efficient circuit protection for today's Appliance-Age homes.

Pushmatic circuit breakers do away with fuse boxes — *just a push of a button restores service.* Every electrical requirement—lighting, appliances, furnaces, fans, even extra circuits — is provided for in one inexpensive, attractive BullDog Electri-Center panelboard.

Builders and contractors appreciate the Electri-Center's centralized efficiency, simple low-cost installation, and trouble-free performance.

Remember — when you specify BullDog, *you specify the finest.* For complete details write: BullDog Electric Products Company, Dept. WD-23, Detroit 32, Michigan.

BULLDOG
ELECTRIC PRODUCTS COMPANY

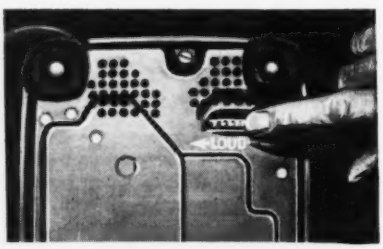
It adds miles to your voice

New "500" telephone. It has already been introduced on a limited scale and will be put in use as opportunity permits, in places where it can serve best. Note new dial and 25 per cent lighter handset.

For years the telephone you know and use has done its job well—and still does. But as America grows, more people are settling in suburban areas. Telephone lines must be longer; more voice energy is needed to span the extra miles.

Engineers at Bell Telephone Laboratories have developed a new telephone which can deliver a voice ten times more powerfully than before. Outlying points may now be served without the installation of extra-heavy wires or special batteries on subscribers' premises. For shorter distances, the job can be done with thinner wires than before. Thus thousands of tons of copper and other strategic materials are being conserved.

The new telephone shows once again how Bell Telephone Laboratories keeps making telephony better while the cost stays low.



Adjustable volume control on bottom of new telephone permits subscriber to set it to ring as loudly or softly as he pleases. Ring is pleasant and harmonious, yet stands out clearer.

QUICK FACTS ON NEW TELEPHONE

Transmitter is much more powerful, due largely to increased sound pressure at the diaphragm and more efficient use of the carbon granules that turn sound waves into electrical impulses.

Light ring armature diaphragm receiver produces three times as much acoustic energy for the same input power. It transmits more of the high frequencies.

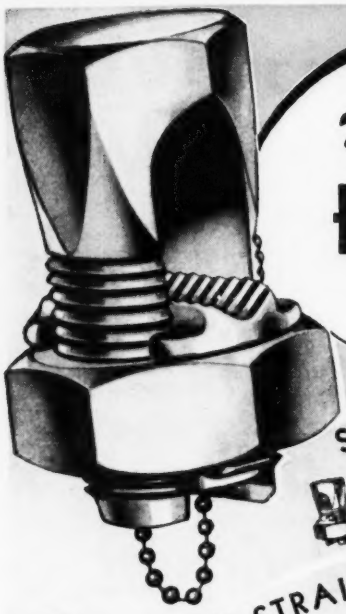
Improved dial mechanism can send pulses over greater distances to operate switches in dial exchange.

Built-in varistors equalize current, so voices don't get too loud close to telephone exchange.

Despite increased sensitivity of receiver, "clicks" are subdued by copper oxide varistor which chops off peaks of current surges.

BELL TELEPHONE LABORATORIES

Improving telephone service for America provides careers for creative men in scientific and technical fields.



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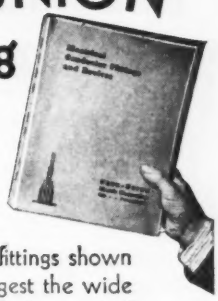

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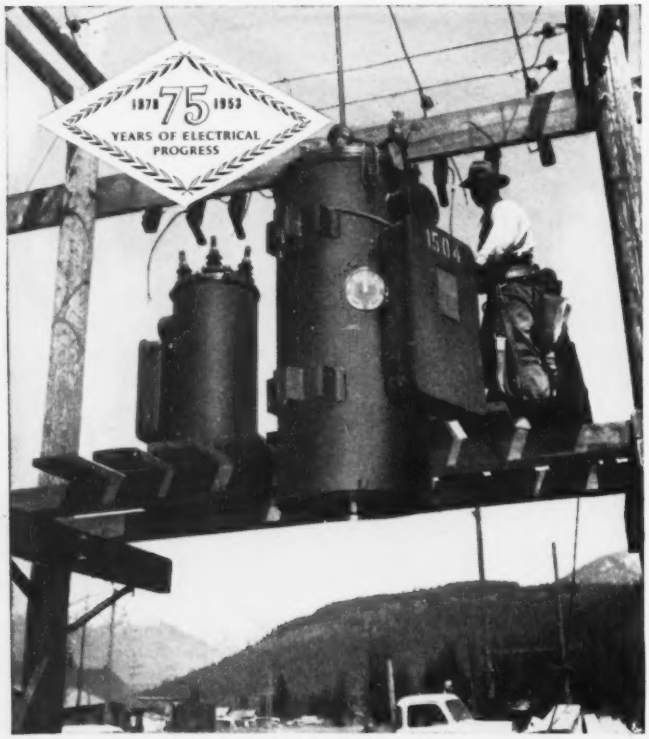

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G-E ML32 step voltage regulators can be obtained for 2500, 5000, 6900, 7200, 7600, and 7960-volt single-phase feeders and the corresponding wye voltages. For complete information, see your local G-E Sales representative. Or write for bulletin GEA-5752, General Electric Co., Schenectady 5, New York. 423-1

OPTIONAL MOUNTING of controls at base of pole—an additional feature of the new G-E ML32—facilitates inspection and adjustment. Note modernized control panel with all control knobs conveniently located.

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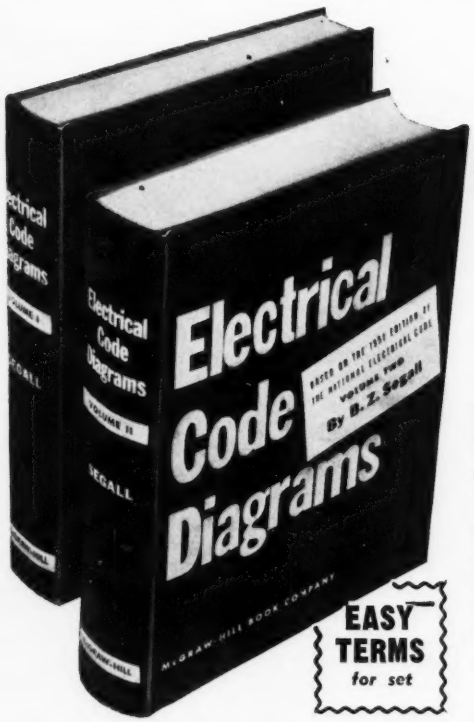

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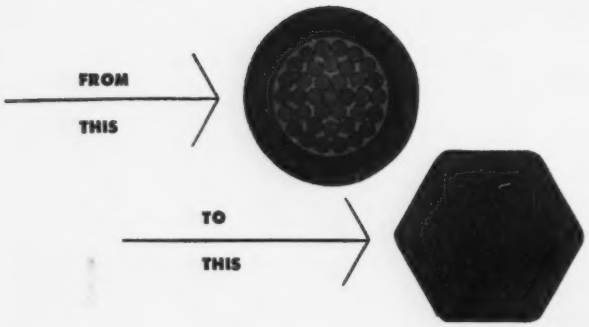

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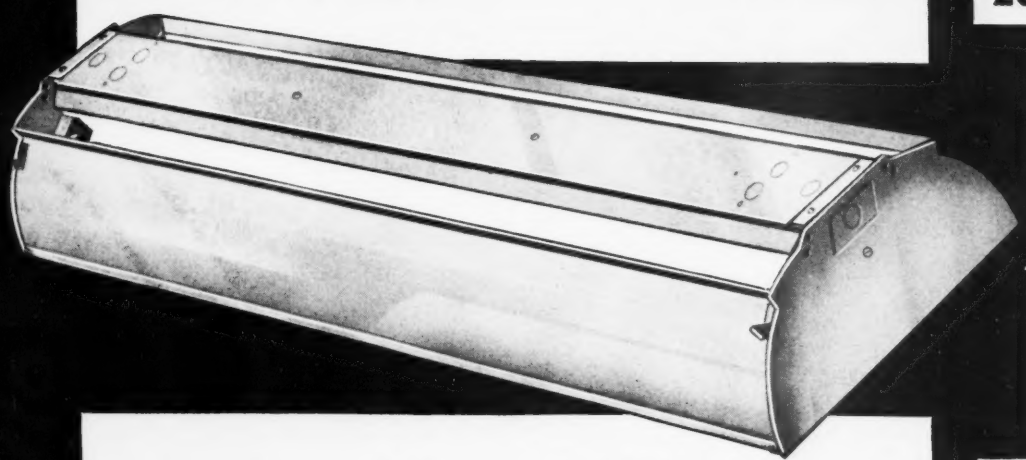

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Rugged?

This Westinghouse transformer survived a fall . . . undamaged!

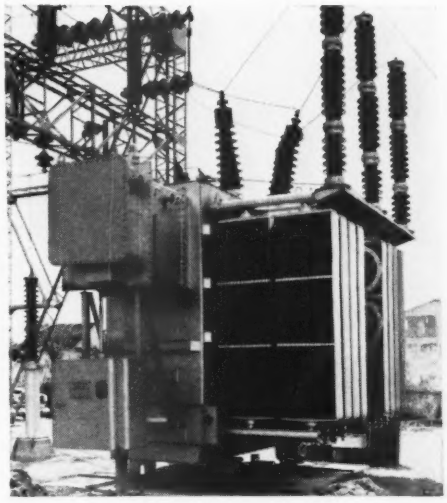
Yes—it does happen. A good example is the case of a large 22,500/30,000-kva power transformer which accidentally slipped, during unloading, from a freight car and crashed to the ground. Although the tank was extensively battered, inspection indicated there was absolutely no damage to the vital parts. After field test, it was installed and put into service. It's been giving a southern utility trouble-free service ever since.

Accidents of this type prove the superiority of Westinghouse Form-Fit power transformer design which assures safe delivery of built-in quality. Shell-form construction with Form-Fit tank results in superior mechanical ruggedness. One reason is that the core surrounds, supports and protects the coils, giving them added strength . . . both mechanically and electrically.

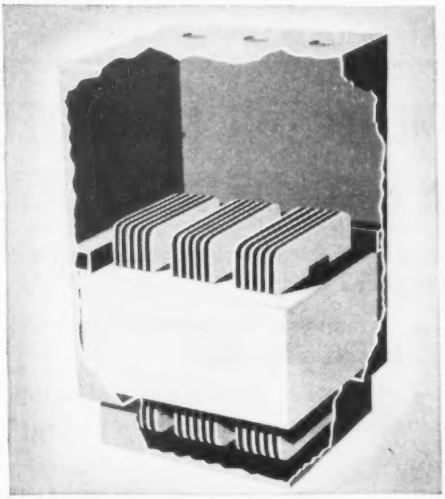
There are other advantages to Westinghouse Form-Fit design, too, which result in long term advantages to you. On the average, Form-Fit transformers are 20% lighter and utilize 15% less foundation area . . . making available substantial savings in installation time and expense.

It's a proved fact that Westinghouse transformers offer greater dependability at reduced costs under all operating conditions. Call your Westinghouse representative. He'll be glad to discuss the application of these transformers to your specific problems. Also available at your request is bulletin B-4142A. Write for it at Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-70670



In service. A side view shows the 22,500/30,000-kva transformer in service after surviving a fall during unloading.



Reason for ruggedness. This core-coil design is the big reason why this Westinghouse Form-Fit transformer reached the site intact. Core surrounds, supports and protects the coils.

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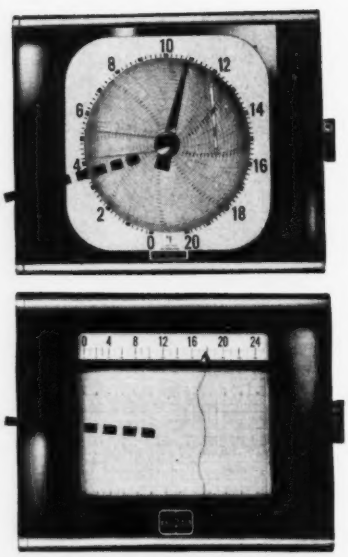

BRISTOL ELECTRONIC DYNAMASTERS are made in round- and strip-chart, single- and multiple-record recorders and air-operated and electric controllers (all types of control actions). Two-pen and Program Control.

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- Thermal emf's at the inverter contacts are self-cancelling and thus have no effect on the accuracy of the Dynamaster.

Write for Catalog P1245 for full data on the Dynamaster. Address The Bristol Company, 116 Bristol Road, Waterbury 20, Conn.

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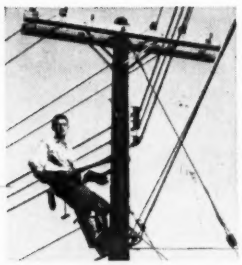
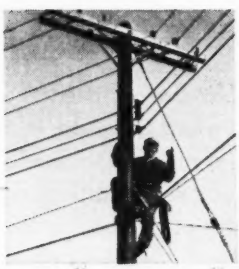
AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

COPPER or ALUMINUM

which conductor shall it be?



"I say COPPER"



"I say ALUMINUM"

"We both agree on ANACONDA"

It's not very strange that this sort of agreement is widespread today.

Cable customers vary in their needs. Some choose copper . . . some aluminum . . . some both.

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PROSPERITY IN THE USA: How Wealthy Are We?

Again, how prosperous *are* the people of the United States?

This is the third of a series of messages devoted to this crucially important and much-debated question. The first two messages dealt with what has been happening to our national income, both in terms of its growth and how it is divided among individuals.

This third message deals with what has been happening to the resources—factories, farms, mines, and equipment of all kinds—out of which income is created. It deals with what economists call our wealth.

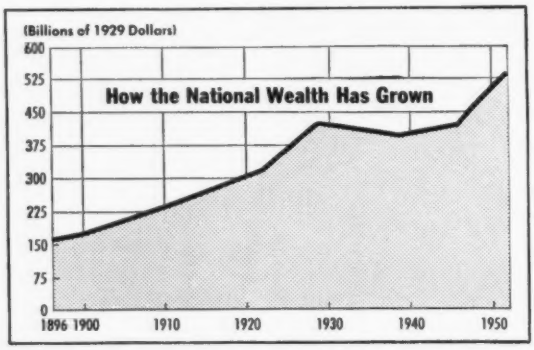
It is possible for a nation to enjoy apparent prosperity for a time by rapidly exhausting its resources. But to sustain prosperity over the long pull a nation must see that its wealth is not dissipated. Hence what is happening to our wealth now is a harbinger of what is going to happen to our prosperity later on.

How Wealth is Measured

It is often asserted that the most vital element in a nation's wealth is its people. There is a lot in this idea. For example, the full value of a country's hospital and surgical equipment depends on its physicians and their skill in handling the equipment.

However, no one has ever devised a satisfactory way to put a value on human beings. So people are omitted from calculations of national wealth. So, too, is military equipment. It is regarded as basically destructive and hence not a real addition to wealth. Otherwise, the wealth of a nation is calculated in terms of the dollar value of its physical resources.

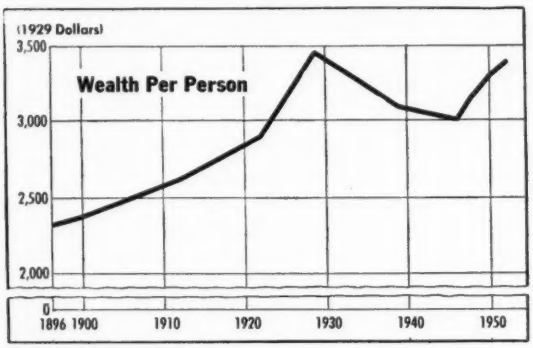
The following chart shows the wealth of the U.S.A. at various intervals during the past 50 years. For the period through 1948 the figures come from a pioneering study by Raymond Goldsmith of the National Bureau of Economic Research, which is widely regarded as the foremost organization in its field. The figures since 1948 are estimated. To remove the effect of price changes, all of the wealth figures are calculated in 1929 prices.



From this chart one fact stands out clearly. It is that since 1929 our national wealth has not been increasing as steadily as it did during

earlier periods. Indeed, in 1946 our total national wealth was actually less than it was in 1929. Only in the last six years have we been able to make any consistent additions.

Even these gains are less impressive when the growth in our population is taken into account, as illustrated by the following chart.



This chart makes it clear that when the nation's wealth is divided by the population, we are slightly worse off per person today than we were in 1929. This is the case in spite of the large additions to our national wealth since 1946.

Depression and war are the two principal reasons we have made no progress in increasing our wealth per person since the 1920s. The depression brought mass unemployment and greatly reduced production which ruled out any increase in wealth. During World War II and again during the post-Korean mobilization program, U.S. production has reached new peaks. But a considerable portion of this record breaking output has been in the form of military equipment, which is not included in an accounting of national wealth. Consequently, we have been unable to regain the level of wealth per person which we had in 1929.

A Brake of Prosperity

What does this failure to raise our wealth per person mean? It means that we have fewer resources with which to create income for each individual. It means that we have made no progress in the crucial task of assuring future increases in prosperity.

As the second editorial in this series demonstrated, we have gone so far in equalizing individual incomes that "the possibilities of increasing the income of the rest of the people by 'soaking the rich' have largely disappeared." From now on the only promising way to increase our individual incomes is to increase our national earning power.

During the past four years it has taken about $3.60 of national wealth to yield $1 of income after taxes. This is a low figure for the wealth needed. Prior to World War II there were long periods when it took at least $5 of national wealth to produce $1 of national income. The experts in this field are by no means certain that it will not again take $5 rather than $3.60 of wealth to increase income by $1.

But let us assume that $3.60 of wealth will suffice to provide $1 of income in the years ahead. If by 1960—seven years from now—the income of the average American is to be increased from about $1490, where it stands at present, to $2000, we must add $310 billion to the national wealth. This is nearly three times as much as we have added to our wealth since the end of World War II, seven years ago.

Because we have made large additions to our productive equipment in recent years, fears are frequently expressed that we shall soon be plagued by an excess of such equipment. But the facts about our national wealth do not support this conclusion. They indicate that we still have ahead of us a tremendous job of increasing our resources if the American standard of living is again to resume the steady climb which was interrupted by depression and war.

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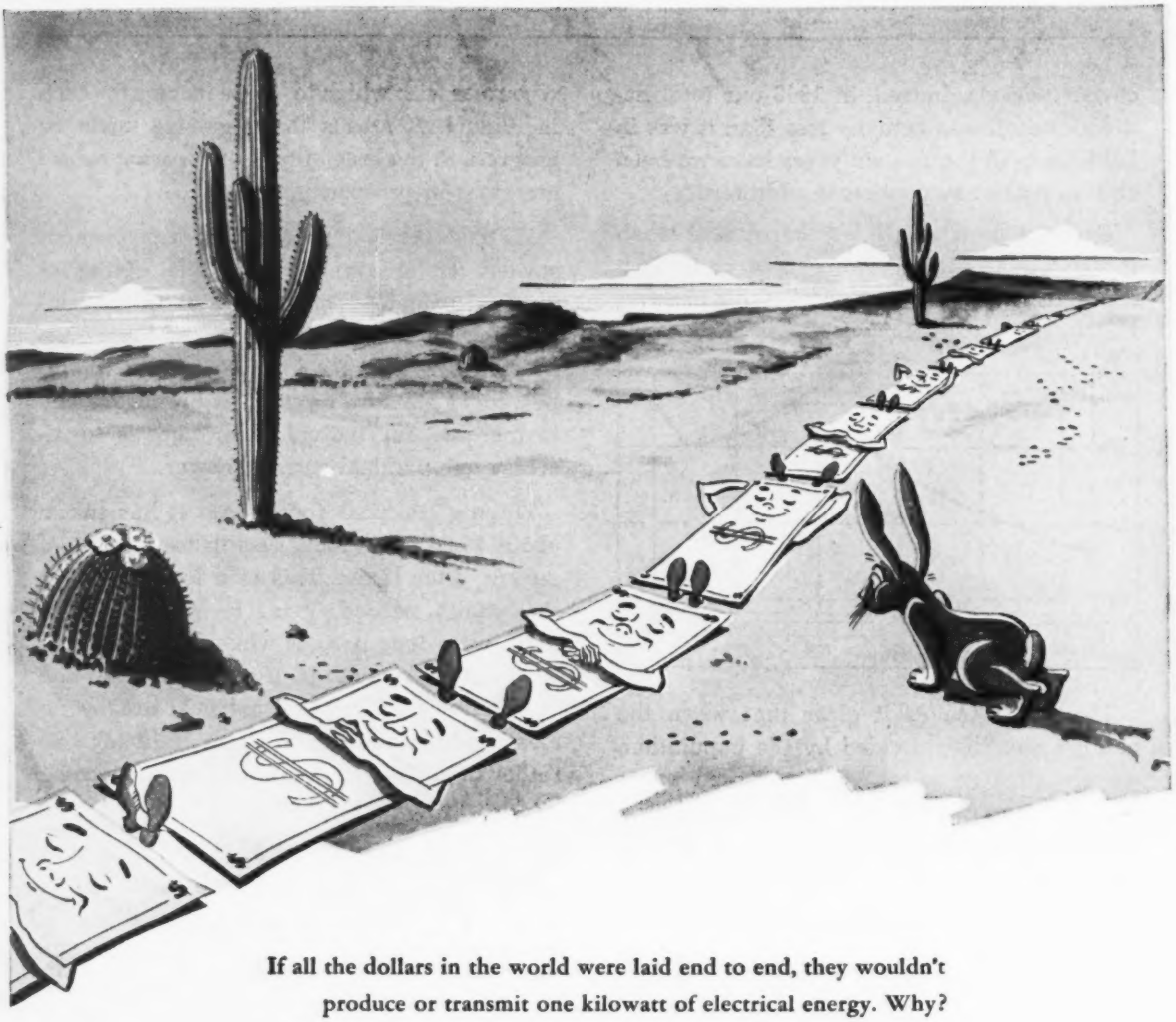

If all the dollars in the world were laid end to end, they wouldn't produce or transmit one kilowatt of electrical energy. Why? Because dollars don't produce kilowatts . . . they just buy them. Raw materials, engineers, designers, fabricators and facilities, together with research and experience, produce them. Kilowatts, once produced, must be transmitted to the consumer. Losses, outages, etc., in transmission can be costly and thus reflect unfavorably against your cost picture. To make sure that you are using the best and most dependable transformers . . . *specify Moloney* . . . so that you can continue to give your customers *better* service.

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Glad to be Aboard

Electrical engineers have staged again their annual pilgrimage to New York. Their Winter General Meeting shattered all records for magnitude and attendance. And throughout the program the evidence was impressive that the American Institute of Electrical Engineers, at the mature age of 68, still retains the vigor of youth.

In the formative years, its leaders, many of them young engineers in a young field, foresaw the great service that the young AIEE and young engineers could do for each other. Very early in its development, they established sections in remote cities and student branches in engineering colleges to provide closer contact.

The branches and sections bring AIEE to its members. They provide a meeting place for men with similar professional background to hear experts in the many specialized branches of electrical engineering. They encourage active discussion of current subjects. They offer opportunity for maturing engineers to acquire experience in speaking before sympathetic audiences. And they train younger men to accept and carry out the executive duties of the institute.

The wisdom of this plan has been proved again and again by the number of men who joined the student branches during college days, gained experience in section activities, and rose to prominence in national committees and general meetings. The recent general meeting was the product of close teamwork by several thousand graduates of this training program. Hundreds of them prepared the papers which made up the program. More hundreds, members of national committees, reviewed the papers and scheduled their presentation in logical progression at the various sessions. Still more hundreds, largely members of New York Section, manned the committees which organized and ran the tremendous meeting. Its great success was a testimonial to the excellent performance of all these members.

But we seemed to detect a new trend. Many of the speakers were younger men. And they performed creditably, while their more experienced predecessors sat in the audience to support them in discussion. This, we think, testifies magnificently to the unselfish devotion of the elder members to their profession. They are wise indeed to encourage younger engineers to share the load while they are still available to offer experienced guidance.

Recognizing early the impending dearth of trained engineers, the AIEE has preached, "Give young engineers more responsibility." Here we saw clear proof that AIEE is practicing what it preaches. Such proof deserves commendation; it will go far to buoy the morale of younger engineers. And youths now deliberating their future careers may feel more favorably inclined toward engineering.

Inside pages of this issue carry an all-too-brief report of the technical program. We hope that they will convey to our many readers who could not attend in person a concise picture of some of the activities. No words can convey adequately the full import of this great meeting. But we are convinced that this was the greatest of a long line of great Winter General Meetings.

So we add our praises to the many being heaped upon the thousands of AIEE members whose tireless efforts produced this great Winter General Meeting. The program was well launched and better handled. We were glad to be aboard.

Worried About Electric House Heating?

"I hope, indeed, that I have very much irritated everybody in this way. I knew that I was taking a most contentious subject. I wished to electrify the industry and the country, too, if I could, to do better things than at present and to push forward on a policy of development which would lead to great benefits in the future."

These words were spoken over 40 years ago by Dr. S. Z. Ferranti in reply to a comment that an address he had just made to the Institution of Electrical Engineers in London must have been irritating to some of his hearers. Ferranti's address set forth his faith in the all-electric idea, including domestic heating.

We found this reference to Dr. Ferranti in No. 120 of the Proceedings of the IEE, published last November. It is contained in a discussion by R. H. Rawll of a paper on electric house heating by D. H. Parry. It is to be inferred from Mr. Rawll's remarks that Parry, like Ferranti, irritated some of his hearers.

Domestic electric heating poses a far more serious problem in Britain than it does here. Shortages of generating capacity and of coal make space "warming," (the British term) a real embarrassment to the electricity supply authorities. It is understandable that those wrestling with Britain's fuel and electricity situation might be a little irritated by advocacy of complete electric house heating.

Here in this country are some who are irritated by talk of house heating, and with far less reason than exists in Britain. Despite the socialistic inroads that have been made on it, our electric utility industry is still an outstanding example of business enterprise. It is a strong and growing business, completely competent to meet the increasing electrical demands of the nation. House heating, small now in the total picture, promises to become an ever larger factor in those demands. Its requirements will be met as they appear, just as others have been met in the past. As for those who are now irritated by talk of electric house heating, worried about the problem it poses, in 1945 they would have been, not irritated or worried, but crushed to a pulp, if they could have foreseen what would be required of industry in the ensuing seven years—capacity increased 60%, output almost doubled. But the job was done, and now there's a bigger job ahead. It will be done, too.

85 Years to Catch Up

The argument has often been heard, especially in regulatory jurisdictions where original cost is the only evidence of value, that in time original cost will approximate fair value. Then all the trials and tribulations which have beset the utility industry since the beginning of inflation will vanish like a dream. But meantime the resultant earnings on an inadequate rate base remain too low.

As always, facts are somewhat less encouraging than fiction. In spite of the unprecedented expansion of the electric utility industry during the period from 1946 to date, which has resulted in an increase in the gross plant account of about 70%, there is still a deficiency of around 40% between original cost and the cost of the plant at present price levels. Assuming no further investment other than normal replacement and no price increase, it would take about 85 years for original cost to equal present cost.

Of course, this condition will actually be reached at a much earlier date. But the problem that will face utility management is not only the one of bridging the hypothetical gap of 85 years. It also concerns the matter of serving and expanding in an economy which may be as different from ours of today as Cleveland's was from that at the beginning of our Republic.

As of this moment, there is no substitute for matching current earnings against a realistic rate base. This is the infallible and permanent solution to the problem.

The Campaign Must Go On

The election of President Eisenhower was a triumph for American democracy. If his opponent Governor Stevenson had been elected, it still would have been a triumph. For the last presidential election marked the fact that Americans are finally approaching political manhood. Last November 61,547,861 Americans went to the polls. This was 12,859,572 more than voted in 1948 and 11,727,549 more than in 1940, the previous high.

This heavy vote did not just happen. Never before in history were Americans so pressured to exercise their rights under the Constitution. Scores of electric companies joined in the drive to get Americans to the polls. But the election of 1952 was not the last election. Before 1956 rolls around there will be hundreds of elections for Congressmen, state and local officials. These elections too will be important. Electric companies should recognize this and should continue their worthwhile campaigns to get all Americans to the polls on every election day.

Eternal Vigilance Is The Price of Liberty

The fact that Congress is setting out to uncover subversive professors, who like to "bite the hand that feeds them," is of more than passing interest. Certainly the effects of these pinks has been felt in many areas of interest to the electrical industry.

All the blame cannot be placed on the colleges, for students seem to acquire socialistic or communistic tendencies at earlier stages in life. A 1951 Opinion Research Corporation survey among 1,280 high school seniors is very revealing. It showed that only 39% felt that keeping the profit incentive alive is essential to the survival of our system. Even more startling, 55% thought the fairest kind of economic system would adhere to the principle, "from each according to his ability and to each according to his needs." Six out of every ten thought that a worker should not produce all he could.

Obviously, with this kind of attitude already existing in the minds of many students, little effort is required to implant unAmerican political philosophies in college students.

However, the mere existence of this situation places much greater responsibility upon the colleges and universities. They must provide the positive rather than the neutral influence on budding young leaders and the high school teachers of the future.

In view of these circumstances and the urgency of a tightening up all along the line, we believe investigations of subversive activities in colleges are entirely appropriate. It would be better if done from within. But a Congressional investigation may be the only adequate assurance of an overall housecleaning.

THE ELECTRICAL WEEK

The Issue's News Highlights—Alex Radin of American Public Power Association and Sen Henry Jackson of Washington tell NRECA Convention delegates to brace for a tilt with private power industry over the federal preference clause.

Washington agencies expect material and production controls affecting electric utility construction to taper off during the next few months.

Electric utilities can't expect any tax cuts to come out of this year's federal fiscal deliberations.

Off the Washington Wire—First economy directive of the Eisenhower Administration is being studied closely by construction agencies. It is almost certain to put a damper on proposed new starts, and call for a revamping of the Truman budget.

Interior Department is now making personnel changes. Nominations have been made for Ralph Tudor, San Francisco engineer, to be undersecretary; Fred G. Aandahl, former North Dakota governor to be assistant secretary for water and power; and Orme Lewis, Phoenix, Ariz., lawyer to be assistant secretary for land. Clarence Davis, Lincoln, Neb., lawyer is to step in as solicitor. Lawrence Smith, Portland, Ore., newspaperman, has already been appointed information chief. Reclamation Commissioner Michael Straus will probably remain at his post until his successor is confirmed.

Interior Secretary Douglas McKay indicated to a House Committee that he has not finally made up his mind on federal construction of Hell's Canyon Project.

REA approved its first generation and transmission loan under the new administration—$764,000 to the Border Counties Power Cooperative in Minnesota for construction of a 1,000-kw diesel plant and 65 miles of 34.5-kv transmission line.

FPC allowed a rate reduction estimated at $52,000 a year on power sales by Washington Water Power Co to Mountain States Power Co . . . Push-up schedule at FPC for handling St. Lawrence Power project applications call for briefs and findings to be filed by Feb. 20 and oral hearings before an examiner on Feb. 27.

SEC has approved $70-million financing program of Electric Energy, Inc. EEI will sell $65 million of 3¾% first mortgage bonds to two insurance companies, $2 million of 3% notes due Aug. 3, 1953 to a commercial bank, and $2.7 million par value of common stock to five utility companies.

U. S. Pipeline Corp, 100 Park Ave., New York City, is planning to build a 1,700-mile pipeline from Beaumont, Tex., to New Jersey to handle refined petroleum products. Electric drives are being considered for all pumping stations along the line. With a 7,500 to 12,000-kw pumping station every 100 miles or so, this would mean a load of between 127,000 and 204,000 kw. Gulf States Utilities plans to serve two 12,000-kw stations.

Ohio Valley Electric Corp lets general building and foundation work contracts totaling upwards of $14.5 million for 1 million-kw Kyger Creek Plant and 1.2 million-kw Clifty Creek Plant. Work starts in 45 days.

Bonneville Power Administration estimates full interruptible loads of aluminum and electro-chemical industries may be back on the lines by Feb. 15. Pacific Northwest may be forced to spill water if rain storms continue as a daily occurrence. By advising these interruptible users that they may come in on full load at any time, it is hoped extensive spilling will be unnecessary. Continued rain and mild weather have filled two of Tacoma City Light's reservoirs to nearly full capacity and utility's generation has been at an all-time high to "keep ahead" of heavy runoffs.

Circuit Judge W. B. Ardery, Frankfort, Ky., denies Eastern Kentucky Rural Electric Cooperative Corp an injunction which would have stopped Louisville G&E from selling 200,000 shares of common.

Boston Edison Co floodlights a 3-acre parking lot in Dorchester, Mass., with 3 to 4 ft-c intensity and an adjacent 10,250-sq ft sales area with 10 ft-c. Fifty-two 1,500-w units are being used.

Lake Superior District Power Co is buying Northern Wisconsin Power Co. Transfer will be effective April 1.

First full scale court test on legality of proposed PUD purchase of Puget Sound P&L will be held Feb. 16 in Thurston County Superior Court, Olympia, Wash. Another case questioning legality of proposed purchase is scheduled for Feb. 20 in Kitsap County Superior Court, Port Orchard, Wash.

Congratulations—John T. Kimball and A. H. Forman, Jr, both vice presidents of Arizona Public Service are named executive vice presidents . . . Long Island Lighting elects Errol W. Doebler president and chief executive officer, succeeding Edward F. Barrett who becomes chairman of board. Edward C. Duffy is elected vice president in charge of operations, construction, and engineering, succeeding Doebler . . . Gordon R. Corey and E. E. Lungren are elected vice presidents of Commonwealth Edison . . . Louis V. Sutton, president of Carolina P&L, receives annual award of North Carolina Society of Engineers for outstanding engineering achievement.

Westinghouse Electric Corp elects E. V. Huggins vice president of corporate affairs. He is also elected as president of Westinghouse Radio Stations, Inc. Joseph E. Baudino is named executive vice president in charge of all operations of Westinghouse Radio Stations.

Sprague Electric Co, North Adams, Mass., elects Julian K. Sprague president, succeeding his brother Robert C. Sprague who is named Undersecretary of Air in U. S. Department of Defense. Company names Ernest L. Ward executive vice president and William J. Nolan becomes vice president, employee relations.

Alex Radin of APPA . . . . . and Sen Henry Jackson of Washington told members of National Rural Electrification Association they should be . . .

Digging in for the Preference Fight

Two proponents of public power took the platform in San Francisco recently to warn members of the country's electric cooperatives to dig in for an attack by the private power industry on the federal preference clause.

The speakers were Alex Radin, general manager of American Public Power Association, and Henry Jackson, newly elected Democratic Senator from Washington. They addressed the annual convention of National Rural Electric Cooperative Association, which met Jan. 26-29.

Radin declared the policy of preference for public bodies in marketing power from federal dams today stands in the greatest danger it has faced during the entire period of its existence.

In spite of the fact that this policy was first enunciated in the Reclamation Act of 1906, he said, and that it has been "reaffirmed and strengthened on at least ten different occasions since that time," there has been in recent months an "ever-increasing clamor from the private utility companies against the preference policy."

Principal charges being made by private utilities against the clause, Radin said, are that it is discriminatory, refusing a fair share of public power to private utilities, and that it stimulates public bodies to condemn private power companies and set up their own distribution facilities.

He termed these two charges simply a "smoke-screen to hide their real purpose, which is to attempt to monopolize for themselves the power produced at these valuable hydroelectric resources."

He and Senator Jackson warned, also, that the aims of the preference provisions could be "undermined or circumvented" in other ways.

For instance, Radin said, plans of the New York Power Authority for development of the St. Lawrence seaway and power project call for substituting a pro-rata plan for power marketing for the preference system.

Again, he said, Georgia Power Co is pressing for a new type of wheeling contract "which seriously violates the intent and purpose of the preference clause." Under this contract, power would be sold at the bus bar to Georgia Power, and the company would serve preference customers.

Three Pillars of REA

Senator Jackson declared that success of the Rural Electrification Administration program depends on federal generation, then on transmission lines, or in lieu of federal lines, "decent wheeling agreements so that you can get power at fair and just prices."

If the private utilities, he said, "are successful in eliminating funds for transmission lines, or if they are will-

ing to sign contracts for wheeling to the REA co-ops that make rates so high that you cannot be in business, obviously they have destroyed the preference clause."

He offered the suggestion that if private utilities should be given equal rights to purchase of power from federal projects, then public agencies should be given equal purchase rights at federally licensed private utility hydro plants.

Jackson, who as a Representative in Congress served four years on the joint House-Senate Committee on Atomic Energy, advised the cooperatives to join forces with other public power agencies in the country and investigate the field of atomic generation of electric power.

Some of the private utilities are conducting research in this field under government contract, he pointed out, and the public agencies—"who have a big stake in this new area of power development"—should make arrangements to participate in proper research in the field.

"I make this recommendation not as a wild dream," he said, "but as something which can be accomplished in the very near future, and I hope that you will participate in this great undertaking so that you can make this energy available for your cooperatives . . . as well as to the private utilities."

G&T Loans Praised

REA's authority to make loans for generating and transmission facilities has been the greatest factor in keeping down the wholesale cost of power to REA borrowers, Claude Wickard, REA administrator stated.

Some rural systems, he said, would not have electricity if it were not for these loans, while others have a lower wholesale rate because it became known they planned to apply for a G&T loan.

"Most if not all, remaining co-ops are enjoying lower rates because they are in a position to apply for such a loan. Your rates will go up and quality of service will go down if you lose such an opportunity."

Private power efforts will continue to limit REA's loan authority in this field, he said. The "Missouri Case" (EW, Oct 20, 1952, p 97) is of particular significance, he said, because it indicates the G&T lending authority is seriously challenged.

"I have always contended there should be no restriction placed on our REA's right to generate power when ample power is not available to them at reasonable price," stated Rep H. Carl Andersen, Republican of Minnesota and chairman of House subcommittee on appropriations for agriculture. "But we don't want to interfere with private business nor do we want private business to stifle us."

In Minnesota the projects on the Missouri are viewed as new sources of power to meet the growing power demand of the REA, he said.

"I could never agree to permit private utilities to control distribution of that vast power at the source," he commented. "Some federal agency must deliver it to REA's municipals and private companies and see that justice is done as far as distribution is concerned."

MISS RURAL ELECTRIFICATION 1953 is Sharon Peterson, left, whose father is with East Central Co-op, Braham, Minn. Chosen as runners-up in the nationwide NRECA contest were Sybil Rensvold, center, Madison, S. D., and Norma Sue Davis, Miami, Okla.

REA'S CLAUDE WICKARD: Every power cooperative has an important stake in the outcome of the "Missouri Case"

The Co-ops Resolve

Convention resolutions called upon the Congress to preserve federal preference policies, as well as the right to enjoy these policies through continued funds for construction of generation and transmission facilities.

The association voiced its opposition to attempts to sell federal power projects to commercial utilities. It supported federal construction of various power projects, including St. Lawrence Seaway, Hells Canyon, Table Rock, McGee Bend, and Devils Canyon. Appropriations were asked for continuation of expansion of steam capacity by TVA, for federal construction of 230-kv lines in western Minnesota, and to provide SPA with an adequate continuing fund.

Construction of Ice Harbor, Hartwell and Upper Columbia Dams and completion of Jim Woodruff and Buford Dams was urged. Appropriations were asked for steam plants to firm up hydro generation where necessary.

Congress was urged to delete the allocation formula from the REA act and leave allocation of loan funds to the administrator.

Officers reelected for another term by the association were Clyde H. Seybold, president; W. Gordon Loveless, vice president and T. E. Craddock, secretary-treasurer.

Key Men at the Control Agencies

(Prepared by Electrical World—Feb. 2, 1953)

Defense Electric Power Administration

Office of the Administrator
Administrator—James F. Davenport (5459-X664)
Deputy Administrator—Edwin J. Dryer (5457-X5237)

Office of Consultant Staff—J. E. Moore (5449-X3611)
Office of the General Counsel—John C. Morrissey (5453-X2698)
Office of Information—George S. Holmes (5443-X3222)
Power Supply Division—Director, Wilford D. Wilder (5448-X621)
Power Requirements Branch—Chief, Clifford Beardsley (3622-X644)
Power Coordination and Planning Branch—Arthur B. Vieregg (5442-X3000)

Materials and Equipment Division Lemore W. Clark (5450-X621), Isaac C. Jeffery (5452-X2411)

Scheduling and Expediting Branch—Chief, John O'Nan (4441-X5316)
Statistics and Procedure Branch—Chief, Ben S. Loeb (4540-X2932)

(Depa offices are in the Department of Interior Building, C Street between 18th and 19th Streets, N. W., Washington 25, D. C. Numbers with each name are room and telephone extensions. Telephone extensions (X) are on Republic 7-1820.)

Electrical Divisions—National Production Authority

Engine and Turbine Division
Director—Edward M. Naughton (3733-X4202)
Deputy Director—E. Joseph Hand (3733-X4202)

Electrical Equipment Division
Director, B. W. Clark (3729-X3256)
Deputy Director, C. G. Laslie (3729-X3257)

(NPA divisions are located on the third floor of the new General Accounting Office Building, H Street between 4th and 5th Streets, N. W., Washington 25, D. C. Numbers with each name are room and telephone extensions. Telephone extensions (X) are on Sterling 3-5200.)

Material Curbs Tapering Off

Material and production controls affecting electric utility construction will continue to taper off during the next few months.

It is still not clear how much of the controls machinery will remain after the June 30 deadline authorized under present law. In his State of the Union message last week, President Eisenhower asked for extension of controls "with respect to defense priorities and scarce critical items essential to our defense."

Extended Life for Agencies? . . . Thus it would appear that Defense Electric Power Administration and the two National Production Authority divisions dealing with electrical equipment will stay in business beyond June 30. If so, primary responsibility of these agencies would be to maintain construction schedules of power plants which will contribute directly to the defense effort. These consist mainly of plants which are to serve atomic energy installations, and for which "E" ratings have been extended (EW, Feb. 2, p 7).

Control agencies dealing with electric power now are working with about half the number of employees which they had in late 1951. Depa's staff now numbers 102 compared with a peak of nearly 200 members early last year. Electrical Equipment Division at NPA now employs 51 persons compared with a high of 99. Engine and Turbine Division at NPA has been less affected. Peak employment of E&TD was 61 persons. Current employment is 49.

Industry's Contribution . . . Industry is still making a heavy contribution in personnel to the control agencies. Industry men serving the government without compensation now number 16 at Depa, 6 at Electric Equipment Division and 16 at Engine and Turbine Division of NPA.

With the possible exception of the Electric Equipment Division, there are no present plans to increase present staffs at the three agencies. It is generally believed the minimum controls envisioned in the Eisenhower message can be administered with fewer men than now employed by the power agencies.

Unless a concerted drive is made to cut the control agencies, it is expected that ordinary attrition will take care of the situation. Persons who resign will not be replaced. This is how most of the previous reductions have been made.

Morale Boosted . . . The mere fact that President Eisenhower asked for extension of limited controls has already served to boost employee morale in the power agencies. This reference in the message is being interpreted as a recognition of the work being performed by the agencies. It comes at a time when many employees are already looking for other jobs.

California Votes Funds for Water Rights Fight

The California legislature passed a bill to make $100,000 available to the state's attorney general and the Colorado River Board for financing the cost of California's presentation to the United States Supreme Court in the Colorado River water rights controversy. The bill was expected to get Gov Earl Warren's signature.

California interests look upon a Supreme Court disposition as a fair solution to the controversy.

For years California's official position was one of desiring Supreme Court adjudication but until several months ago Arizona opposed taking the matter to the highest court in the land. Arizona changed its mind several months ago.

The way was cleared for Supreme Court action when the court granted Arizona's motion for leave to file a bill of complaint.

The next step will be for California to file its answer to the Arizona complaint. The United States Department of Justice has filed a motion for leave to intervene but will not file its complaint in intervention until California has filed its answer to the Arizona action.

Ike's Views on Water Policy . . .

. . . are revealed in State of the Union message. President advocates strong federal participation in resource development

Strong federal participation in water resource development will continue under the Eisenhower Administration.

The new Republican President made this much clear in his first message to Congress last week outlining parts of his legislative program. More specific suggestions will come later.

Although President Eisenhower called for no basic departure from established federal power policy, the tone of his speech indicated administrative changes may be in store.

Outlines Resources Policy . . . Main points of his speech relating to electric utility matters:

- Soundly planned water development projects already initiated will be continued, and comprehensive plans will be drawn for future projects.
- The federal government will be a leading partner in the field of resource development along with state and local bodies.
- Conflict and duplication among federal agencies handling resource development must be eliminated and studies toward that end are in progress.
- Tax reductions can only be justified if budget can be balanced. (See page 84).

Context of the Eisenhower message appears to cast a shadow over the future of such projects as the 425,000-kw Oahe multi-purpose project in South Dakota and the Tuttle Creek flood control reservoir in Arkansas and Missouri. Both these projects, for which contracts have been let, are under fire from local interests. There appears to be growing support in the area to modify the Oahe project plans to provide for a smaller reservoir.

Reopening of Hearings? . . . Whether such opposition could be taken to mean the projects were "unsoundly" planned is open to administrative interpretation. Language of the Eisenhower message would seem to leave the way clear for reopening hearings on these two projects. However, it is doubtful that Congressional committees would reverse themselves on these two controversial projects.

While stressing the need for local participation, President Eisenhower called specifically for "a strong federal program in the field of resource development." This would seem to scotch rumors that federal participation will be kept at a minimum. In his speech to Congress, Eisenhower said such civil works should be timed where possible "to assist in levelling off peaks and valleys in our economic life."

Would Bar Overlapping . . . Through administrative procedure, for which some legislation may be needed, Eisenhower hopes to avoid overlapping procedures among various federal agencies in resource conservation development.

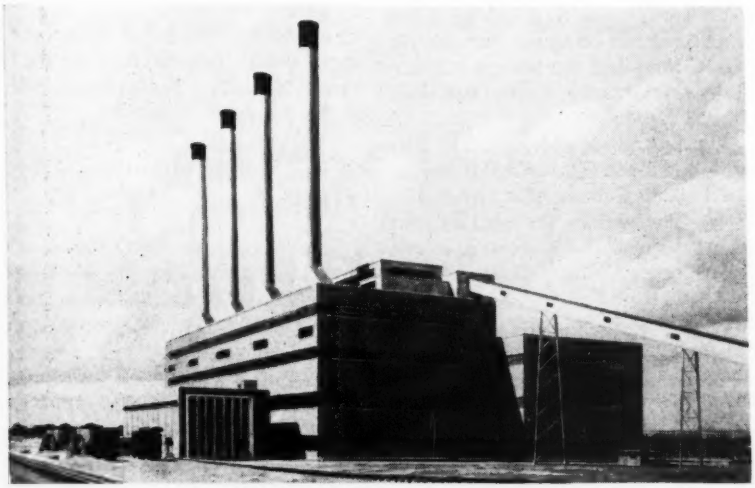
Presumably this relates to jurisdictional disputes such as have occurred between the Army Corps of Engineers and the Bureau of Reclamation over flood control and irrigation development in the Missouri Basin and and Central Valley of California. It would also include eliminating conflicts between the departments of Agriculture, Interior, and Federal Power Commission relating to flood control, waterway development, and generation and sale of power.

In developing its own water policy, the new Administration will get plenty of advice.

Water Policy Conference . . . Under the aegis of National Water Conservation Conference, state reclamation associations, interstate compact commissions, National Rivers and Harbors Congress, Mississippi Valley Association, and other regional and national groups concerned with land, water, and power resources are meeting this week in St. Louis. The conference is expected to adopt a joint statement of policy to guide all member organizations in advising Congressional committees and federal officials on revision and interpretation of federal laws.

Water interests represented in the conference are in large measure exponents of the resources thinking enunciated by President Eisenhower during the campaign. These same interests also are in accord with much of the tightening and recasting of water procedures called for by Congressional committees during the past year.

A nine-man committee that has been considering a national land, water, and power policy for the conference will report its recommendations to a general meeting of the conference Wednesday morning, Feb. 11.



Work Starts on Illinois Project

This is how Commonwealth Edison's new Will County generating station will look when it is completed. Preliminary excavations and substructure work for the plant have been started. The station is expected to be completed and the two new units in service by late 1954.

The Will County Station site is adequate for the development of a 1-million-kw plant, more than three times the initial capacity to be installed.

REP DANIEL A. REED

SEN EUGENE D. MILLIKIN

No Tax Cut Seen for Utilities

Electric companies aren't in for a federal tax cut this year.

But the men and women who make the utilities tick may be in line for lower individual tax rates in calendar 1953.

These were the prospects last week after Congress had listened to President Eisenhower's State of the Union message. Eisenhower asked that tax reductions be deferred until a balanced budget is in sight. But the language of his message did little to reduce the tremendous pressure being built up in Congress for tax cuts—particularly in the House. It remains to be seen whether Eisenhower plans to fight tax reduction to the last ditch, until the budget is balanced in fact. As things stand now, though, chances are that reductions are likely to come this way:

- A 5½% cut in individual income taxes. This would mean removal of half of the tax increase brought about by the Korean War.
- Expiration of the excess profits tax June 30. This would have the effect of cutting it in half for the year.

But neither of these proposed cuts would relieve the tax burden now levied directly on electric companies. Because they are regulated by state and federal agencies, they are now exempt from the excess profits tax. No relief is in sight this year from the corporation tax, which hits the electric companies.

Lower corporation income tax may be in store next year or within the next few years.

Administration demand for a balanced budget brought no hint from Chairman Daniel A. Reed of the House Ways and Means Committee that he would hold up his bill. This bill, which he expects to clear the committee by Feb. 17, would cut personal income tax this year by 5½%.

Bottling Process . . . House leaders do plan to bottle up the bill until they have a clearer idea of appropriation requirements, but if they hold it too long Reed will be on the warpath. He has already said the tax cut bill will be scrapped only "over my dead body."

On the Senate side, there is less rush. Chairman Eugene D. Millikin of the Finance Committee is expected to go slow in handling the Reed bill, but many lawmakers are certain it will clear Congress before adjournment.

EPT Will Die . . . There seems to be no real effort in Congress to prolong the 30% excess profits tax levied on corporate profits as an emergency measure. This is now set to expire June 30. It will take affirmative action to retain it. For that reason, it would be more difficult to keep it than drop part of the individual tax increase.

Republicans, with an eye on the 1954 elections, do not want to be accused of lowering corporate taxes while keeping individual taxes at present levels. For that reason, chances are good that cuts will be made on both by mid-year.

Curb on PUD's . . .

. . . proposed in Washington State bill. Condemnation powers would be affected

A bill introduced in both branches of the Washington state legislature is likely to bring an early showdown in the battle between public power and private power forces for control of the 1953 session. It would virtually kill the present law allowing public agencies to take over private power properties by condemnation, by requiring prior approval from the state Public Service Commission.

To obtain such approval, the agency would have to prove its existing sources of power were inadequate, that the loss of facilities by the private company would not impair its ability to adequately supply its customers and that the property acquisition was in the public interest.

Aimed at Chelan PUD . . . The Senate bill admittedly is aimed at halting the Chelan PUD's proposed acquisition of the Washington Water Power Co's Chelan Falls dam. But it also would be effective in other actions against privately owned power facilities.

The bill apparently would affect condemnation suits already filed against Puget Sound Power & Light by PUD's but not by cities. Its principal effect in the Puget Sound purchase would be to weaken the PUD threat of pushing condemnation suits if the purchase plans stall.

Ship's Boom Rips Down 110-Kv Lines of PG&E

The biggest ship ever to enter the port of Redwod City, south of San Francisco, broke Pacific Gas & Electric Co's 110-kv lines at the mouth of the channel Jan. 24.

Going in at high tide, in ballast, the tip of the S.S. George Luckenbach's boom hit the overhead lines, ripping them down into the water. There was no damage to the 492-ft vessel.

PG&E spokesmen said that the maximum outage was 6 minutes, but that it was 40 minutes until the entire load was restored in the area from Redwood City to South San Francisco.

The ship was in port to pick up a cargo of magnesite for Rotterdam, and was low enough in the water after loading to clear the restored wires.

H. J. Scholz, president, Southern Services, Inc; Elgin B. Robertson, AIEE presidential nominee and president, Elgin B. Robertson Co; and W. J. Seeley, professor and chairman of Electrical Engineering, Duke University, survey the program for the Winter General Meeting

AIEE Surveys Utility Problems

More than 400 technical papers filled the 88-session program of the American Institute of Electrical Engineers Winter General Meeting at New York, Jan. 19-23. A record 4,676 members and guests attended.

Subjects ranged from industrial plants to railroads, from microwave to house heating. But utility problems enjoyed their usual prominence. Engineers from utilities, consulting firms, and manufacturers occupied the platform at many sessions and contributed generously to the program.

Steam Station Performance Improves

Controls and performance of turbines and boilers are moving forward to keep step with the attained refinement of controls for tie-line transfer and optimum loading of stations and units. This was established in an all-day symposium arranged by the Power Generation and System Engineering Committees.

Cyclone steam separators permit wider latitude of boiler water level as controls maneuver the steam generation to match turbine-generator demands. Likewise temperature controls for modern high-pressure high-temperature units (including reheat) have surpassed those for prior units. Pressure firing (17 in service, 63 on order) is reported as providing improved and safer operation with simplification of control equipment.

Extensive tests show that the response of prime movers to changes in system frequency or to supplementary controllers is of a random nature and bears little relation to machine rating or to steady-state speed regulation. However, good speed governing systems on newer units can improve system operation particularly if the units are not run with valves wide open. Manufacturers' experience is, unfortunately, that many operators make faulty governor adjustments and thus lose some of the potentialities of excellently designed governing systems.

Obsession for efficiency may result

E. M. Strong, president IES; L. R. Gaty, Philadelphia Electric Co; C. T. Hatcher, chairman, AIEE Winter Meeting, Con Ed Co

A. E. Silver, retired; R. E. Peterson, Line Material Co; and L. G. Smith, Consolidated Gas Electric Light & Power Co of Baltimore

in operation just below a valve-cracking point where heat rate is best but incremental regulation broadest. Many more complaints are received by manufacturers that the governors are too sensitive than the reverse. That attitude impedes refinement.

Larger load changes with insensitive or blocked governors require automatic controllers to maintain frequency and reduce exchanges over tie-lines. To supplement the normal regulators without impeding their functions a combination mechanical-electrical device has been developed to contend with large and quick load changes.

The purpose of such fringe controls is to produce a generation change in the area where fringe variations occur rather than transmitting the fluctuations over a tie-line. Controlling generation automatically in response to fringe changes should be investigated if the fluctuations limit the maximum scheduled power transfer on the ties or the rate of response to sustained load variations.

Controlled by Load Dispatcher . . . As in sustained load control, controls for fringe load variations are manipulated by the load dispatcher. Thus he not only controls transmission switching but also assigns load to obtain the most economical overall operation.

Another control system discussed, a 1953 simplification of a 1948 design, purports to:

1. Avoid costly duplication of control equipment at each station.

2. Eliminate drift in station and tie-line loading caused by differences between frequency standards at different stations.

3. Permit the load dispatcher to adjust frequency, tie-line load schedule, frequency bias setting, base or maneuvering point load, permissible regulating range of each station, and distribution of load changes between stations. This does not burden the dispatcher with load division between machines in each station, which, the author believes, properly remains the task of the station operator.

Concluding the symposium was a presentation of swinging load tests conducted on a steam plant to evaluate effect on plant economy. These data and discussions indicated that only minor increases in plant operating costs are caused by swinging loads; they might even be attributed to inaccuracies in instrumentation. No attempt was made to evaluate additional maintenance of moving parts.

Discuss Excitation Systems . . . Magnetic amplifiers replace rotating amplifiers in a new excitation system described by three Westinghouse authors (Carleton, Bobo and Horton). A self-excited main exciter capable of independent manual operation is the foundation, and it has two separately excited control fields for buck or boost under Power Magamp energization. Push-pull circuitry supplies the reversal. Response is claimed to be nearly instantaneous, and low input power level results in an easily damped system.

Implication that rotating regulators in general need improvement was countered by exponents of the Amplidyne who cited better than 500 machine years of successful, low-maintenance, high-reliability operation. A hydro operator added 16 machine years of no-outage operation except for one instance of faulty control contacts.

Consultant F. W. Gay said operators generally are skeptical about voltage regulation which limits their own control of voltage and for that reason advocated omitting the automatic buck. With "the bugs" quickly removed the new device, he felt, should quell the operators' reluctance to welcome automatic regulators. W. S. Price reported an experimental installation on the American Gas & Electric System similar to the new Westinghouse scheme, hoped that rotating devices could ultimately be eliminated completely.

Motor Information Needed . . . Much confusion and faulty performance of motors on power plant auxiliary drives could probably be avoided if users would supply more information about load characteristics when they specify motor characteristics. This was a definite inference from discussion of a paper by W. M. Schweder, General Electric, following companion papers by Westinghouse and Elliott authors summarizing the principles to observe in matching the motor to its load and atmospheric environment.

Chairman J. G. Noest, Consolidated Edison, admitted being "fussy" but compensates for detailed specifications by supplying information generously. He is not disposed to be critical about

R. J. Wiseman, Okonite Co; E. W. Davis, Simplex Wire & Cable Co; and J. Elmer Housley, former president AIEE, Knoxville Power Co

C. A. Wagner, Westinghouse Electric Corp; E. M. Hunter, General Electric Co; and A. A. Johnson, Westinghouse

power factor because "reactive is not particularly expensive in the power house"; however, penalties set for efficiency departures may be based on $300 or $400 per kw. Schweder suggested at one point that the industry equip itself to measure accelerating torque by coupling motors to actual load machines for test.

Boiler-feed pump drives are approaching the 3,000-hp level for large turbine-generators, and the need exists to examine the relative economies of various modifications of current practices. In analyzing these influences, R. W. Ferguson and E. W. DuBois, both Westinghouse, pointed to increased operating speeds as warranting smaller sizes and lower costs per horsepower.

Variable speed drive was cited as offering substantial savings over constant speed plus throttling; the wound-rotor motor was the means suggested with step-up gears for both higher pump speed and output adjustability. The hydraulic coupling has become well established, but improvement in liquid rheostats has given the wound-rotor motor fresh appeal with the possibility of deriving nearly twice the return on added investment.

Solving the Flash Problems . . . Air pollution is an increasingly active issue. At one of the power generation sessions much light was thrown on the efficacy of measures to control stack emission. Highest possible peak voltage must be maintained for maximum effectiveness of electrostatic precipitators, said H. A. Bauman, Consolidated Edison. Also there should be ample power input to support the voltage, say 9 kw per 100,000 cu ft of flue gas per minute for 97% extraction. Likewise he advocated 8 to 9 sq ft per cfs with velocities as low as 5 to 7 fps.

When combustible content exceeds 10%, the efficiency suffers, and re-entrainment of large coke particles may occur. Stack puffs should be eliminated by continuous rapping with blows of carefully controlled intensity. A mechanical collector of 75% efficiency in series with an electrostatic precipitator of 96% efficiency will result in 99% collection if both equipments are well maintained.

Effective precipitation, said H. J. White, Research Corp, calls for putting a 25,000 electron charge on a 10 micron diameter particle. This with a 4,500-v-per-cm field imposes a 300g force on the particle. Force is inversely proportional to particle size. Meanwhile combustion gas amounts to some 1.35 lb per pound of steam generated.

From these basic values White proceeded to discuss optimum design of precipitator. He claimed that cycled magnetic impulse rapping should give 98% performance and no puffs. J. C. Falkner, Consolidated Edison, suggested that operators may not have been provided with enough instrumentation and controls to maintain the electrostatic precipitator at best efficiency.

Hydro Systems Save with Automatic and Remote Control

The cost of automatic and supervisory control of six of the eight hydro-electric generating stations of Calgary Power, Ltd, is less than the estimated cost of housing accommodations to provide for manual operation of the plants. Capital expenditures for the system control center and control in the six plants approximate $250,000, varying from $20,000 to $45,000 per plant. Housing for additional personnel to operate the plants would have cost $350,000. This economic condition was reported by T. E. Cardell, M. W. Clarke, and H. Randle of the Canadian utility.

As attended plants, the six plants and control center would be staffed by 47 men, with salaries, fringe benefits, etc., averaging $5,200 per man per annum, or operating labor costs would total $244,400 per annum. The "automatic-supervisory system" now employs 19 men and the labor costs are about $98,800 per annum (excluding superintendents and maintenance crew). These plants operate in a 281-Mw interconnected system.

Provides Complete Protection . . . All plants have similar automatic equipment. Each is reported to be completely self-protecting when operated automatically. Time and load apportionments are maintained by automatic load and frequency con-

trollers. A mechanical clock sends an accurate one-second signal every 20 seconds to the load controllers in each plant. Signal, supervisory, audio monitoring, and carrier telephone are carried on metallic circuits. Power is supplied by a 10-kw, 120-v, 3-phase, motor-generator operated from the battery.

Construction of a 112.5-Mw hydroelectric project involving three plants is nearing completion in the Owens River Gorge, according to O. L. Sidenfaden, Los Angeles Department of Water and Power. Upper Gorge Plant cannot be operated until a water tunnel is completed from Crowley Lake. Operation of Middle Gorge Plant and Control Gorge (lower) Plant indicates that the use of outdoor construction, identical units, and remote control will fulfill the requirements. He said that the total average static head from intake to discharge in the river is 2,400 ft. Each plant is connected to a 230-kv bus which feeds into a 230-kv single-circuit line terminating 260 miles away at Los Angeles.

Combating Frazil Ice . . . Ways to minimize the effect of "frazil" (fine needle or crystal-like) ice on generating station capacity were explained by K. I. Granbois, Safe Harbor Water Power Corp. At Safe Harbor and Holtwood Stations on the Susquehanna River, one or more of the following have been used when a temperature recorder indicates possibility of ice forming in the early morning:

1. Remove trash screens.
2. Pass steam through the hollow stay vanes of the turbine distributor ring.
3. Keep wicket gates moving.
4. Close wicket gates, run the machine as a motor to provide agitation and generate heat from additional hydraulic losses.
5. Electrically heat trash screens.

Protecting Generators Against Line-to-Line Faults

New information on what happens in the generator when a line-to-line fault occurs on the system and what to do about it was the focus of several sessions. It was agreed that stresses from negative-phase-sequence currents under such conditions were more severe than under three-phase fault conditions. Revision of ASA C-50 covering this condition was recommended. On 15 to 20 Mw units, E. I. Pollard, Elliott Co, reported rotor damage under these conditions occurs first by loss of shrink fit of retaining rings on the rotor body because of overheating. On larger units, M. D. Ross, Westinghouse, said failure occurs first in the aluminum alloy wedges that hold the rotor coils.

Propose New Relays . . . Relay engineers reported the development of three new relays for the protection of generators against such faults. One that matches the characteristics of the revised ASA-C50 standards was described by W. E. Glassburn, Westinghouse. Basis of the design is a negative-phase-sequence filter. Another which responds only to negative sequence was described by L. E. Goff, General Electric. It is designed to sound an alarm on small currents, trip on larger currents. A 120-cycle relay was described by Dr. E. T. B. Gross, Illinois Tech.

Operating men questioned the desirability of tripping generators, but discussion indicated that there had been enough cases of trouble to prompt the studies and development of suitable relays.

330-Kv Transmission May Use Wood-Pole Structures

Wood-pole structures may supersede steel towers for transmission lines up to 330 kv, said L. B. Murray and C. P. Ussery, Alabama Power Co. Although steel-truss crossarms are required for pole structures of this size, the line cost is lower. Despite occasional pole replacement, the cumulative annual cost also is reduced. Both designs utilize 18 insulator units per suspension string which, with two shield wires and 15-ohm footing resistance, promise 0.5 or less lightning interruption per 100 miles per year.

A. A. Osipovich reported that Bonneville is using both wood and steel structures for 220-kv, single-circuit lines. BPA prefers steel for double-circuit, and for new 230-kv lines which may be converted to 300-345 kv. Wood is considered neither adequate nor economical for this application.

Wood proved cheaper than steel for two 100-mile, 230-kv Indiana Public Service lines. W. A. Schulz and L. B. LeVesconte found that 12 insulator units per string on wood crossarms, with two shield wires and 10-ohm footing, would have less than 0.5 lightning outages per 100 miles per year.

Steel Towers Redesigned . . . But steel towers may not be finished yet. Several discussers have investigated new designs to reduce weight and size. The Swedish type of steel H-frame has not been found attractive because of greater foundation cost. But A. N. Shealy and Eduard Fritz, Pennsylvania Water & Power Co, found that redesigning the standard 220-kv, single-circuit, steel tower saved 12.3% steel weight and 10.2% total material costs. Others noted the greater reliability of steel structures, freedom from fire and woodpecker damage, and longer spans. Where two circuits are required, rights of way for steel towers are easier to procure because they require less ground than guyed wood structures.

Hexafluoride Quenches Arc . . . Sulfur hexafluoride offers a new arc-quenching medium for high-voltage, load-break switches, reported H. J. Lingal and J. B. Owens. This gas is stable and has 100 times the a-c interrupting ability of air, said Lingal, A. P. Strom and T. E. Browne, Jr, all Westinghouse. Mixed with air, it still retains superior interrupting ability roughly proportional to its concentration in the gas mixture.

The sulfur hexafluoride is applied to standard airbreak switches in a sealed auxiliary interruption chamber which carries current momentarily after the main contacts part. This switch fills the need for an inexpensive device capable of interrupting line and capacitor charging currents, load, and transformer magnetizing current.

W. A. Schulz, Public Service Co of Indiana; R. A. Larner and O. S. Hockaday, both Texas Electric Service Co

E. L. Kanouse, Los Angeles Dept of Water and Power; J. A. Rawls, Virginia Electric & Power Co; and A. E. Paige, University of Denver

4-Kv Distribution Not Obsolete . . . Higher voltage distribution may cost more than the prevailing 4 kv in heavy-load-density areas, said H. G. Barnett and D. N. Reps, Westinghouse. The distribution transformers constitute an important factor in system cost. Where distribution substations must be provided to step down transmission voltage, the difference is not appreciable. But light load density, where feeder loading is limited by voltage drop, is the most favorable place for higher-voltage feeders.

W. R. Bullard, Ebasco Services, took exception, citing the growing difficulty in procuring locations suitable for 4-kv distribution substations. He referred to the continuing increase in transmission voltage, claimed that distribution systems have not kept pace.

But on the other hand, said H. B. Wood, Duquesne Light, few metropolitan areas are suitable for 22-kv distribution. Any possible savings would be offset by poorer service reliability unless costly sectionalizing was provided.

Bigger Circuit Breaker

A new 10,000-Mva, oil circuit breaker, said to be the forerunner of "an entirely new line of high-voltage, high-capacity breakers", was described by C. J. Balentine, C. M. Ratliff, Jr, and G. C. McBride, all General Electric. This 161-kv breaker has a 1,600-amp rating, clears in 3 cycles, and recloses in 20 cycles. Basis for the new line is the multi-break interrupter in which oil is pumped through the arc chambers. The pneumatic operating mechanism was described in a companion paper by E. B. Rietz.

Improved medium-voltage, oil circuit breakers have been achieved by redesigning the oil-blast interrupters, said R. B. Shores and E. J. Olsen. Low oil carbonization and reduced contact deterioration insure savings in maintenance, the GE men said.

DBPC in transformer oil does not impair use in oil circuit reclosers, reported K. Oura, R. N. Hazelwood and R. M. Frey, Line Material Co. Discussers agreed that DBPC is desirable in transformer oil, looked to clearance to use it in circuit breakers to eliminate the need for separate storage of oil.

Lightning Data Checked

Progress in lightning protection has been great but some of it still hinges on computations based on assumptions of a simplifying nature. The ground return is taken to be a plane, and adjacent metal structures are commonly neglected in transmission protection analyses. There is considerable residual doubt about the voltage distribution under surge conditions.

One of the transmission and distri-

M. S. Oldacre, Utilities Research Commission; H. P. Seelye, Detroit Edison Co; C. A. Powel, former president AIEE, MIT, and J. T. Lusignan, Ohio Brass Co

H. B. Wolfe, Duke Power Co; L. F. Kennedy, General Electric Co; W. R. Brownlee, Southern Services, Inc; and W. J. Ellenberger, U. S. Army General Staff

bution sessions saw the details of a portable instrument to generate low-voltage surges and explore the resulting voltage, attenuation, coupling, surge impedance, etc. This new tool is the synchronograph, a Westinghouse development described by E. L. Harder and J. M. Clayton.

H. L. Rorden, Bonneville, interpreted the device as something that might explain the anomalously good performance of a circuit breaker despite calculations that indicate the arrester too remotely located to protect it. Prof J. R. Eaton, Purdue, asked for explanation of the discordantly high losses that have to be assumed to account for the attenuation experienced in cables. Harder admitted that something is missing in the theory or the calculations, implying that the synchronograph may help to find the answers.

Peruvian Experience Differs . . . Lightning experienced on a 50-kv line in the mountains of Peru led to installation of a mast and counterpoise diverter system that cut the service interruptions to one-sixth. The installation was placed at a 14,650-ft altitude where barometric pressure is 60% of sea level. One stroke of 186,300 amp provoked discussion from W. W. Lewis, Union College, who had collaborated with author C. M. Foust in early GE studies on the Public Service of Colorado system which indicated no strokes above an 18,000-ft level. Discussion seemed to attribute the difference to the 40 deg latitude in Colorado and the 10 deg in Peru with corresponding difference in prevailing temperature.

At this same session a committee report on line expulsion arresters (13 to 138 kv) indicated that they had decreased line interruptions from 81% on 13 to 35.5-kv lines to 66% on 100-138-kv lines. A trend toward use on low-voltage lines is anticipated. Cost for comparable protection is estimated to be 10 to 30% more than overhead ground wire.

Discuss Arrester Characteristics . . . The survey report on performance characteristics by the lightning protective devices subcommittee provoked discussion of the need for new testing methods. Several users argued that the 10 x 20 current surge test is not consistent with the 1½ x 40 voltage test. Others contended that such a change would confuse the established approach to insulation coordination, which has proved successful. They also cautioned against prescribing tests that laboratories cannot attain.

Protection of transmission substations by overhead shield wires or vertical masts has proved successful, reported a working group. Nearly half of the companies which have not adopted such protection now indicate plans to apply it in future designs.

Frequency Crowding Creates Problems . . . Crowding of the frequency spectrum and the need for getting more signals through at the available frequencies were the themes of carrier current papers and discussions. Methods of rating carrier equipment were proposed by T. A. Cramer, General Electric, and in the discussion L. E. Ludekins, Southern California Edison, suggested that the channel itself should be rated first.

Carrier noise level measurements must be related to a standard noise meter band width to be of any value, said B. J. Sparlin, Westinghouse, who told how it could be done. Frank B. Gunter, Westinghouse, described a new line of carrier equipment that can be used either with batteries or an a-c supply.

Eight filter designs, developed by General Electric for application on existing carrier equipment to raise the selectivity where necessary because of crowding of the spectrum, were described by D. C. Pinkerton. Cost is estimated at one third that of replacing equipment.

Urges Pilot Wire Improvement . . . Availability of pilot wire circuits for relaying purposes is good. Their use is increasing, and fault detectors would greatly decrease the number of incorrect operations. These were conclusions from a subcommittee survey.

Backup relaying practices vary, but most companies do not provide generator back-up protection as such, relying rather on clearing faults at some other point on the system, according to a project committee report. The latter practice often involves loss of load; so it was proposed that economical measures of avoiding this would be desirable and studies should be made toward that end.

In a survey on remote tripping schemes a project committee found that the use of grounding switches to draw sufficient current to operate relays was more prevalent than had been assumed. Other schemes used were back-feed tripping and transfer tripping.

Differences Flare Over Pipe Cable Heating

Growing acceptance of pipe-type cable is focussing attention upon its ability to dissipate heat directly into the soil. Cable engineers urgently need an adequate method to determine its safe current capability.

Several years study by a working group culminated in agreement that a better simplified method was needed. Spokesmen for the majority propounded rigorous mathematical methods. The minority contended that relative inaccuracy of heat absorption data for the soil surrounding the cable,

and doubt about other variables, does not justify precise formulations. It offered a quick empirical method claimed to be adequate for practical use.

Discussers cited tests of soil characteristics and cable temperatures on several utility systems. Some noted the great importance of the thermal qualities of backfill in cable trenches, advocated assignment of a qualified field engineer to supervise this function.

Companies which had long periods without rainfall last summer report cable temperatures approaching "run away" in poor locations. One advocated six-foot trenching to reach permanently moist soil. Another proposed drilling pavement and pumping in water. Practices for keeping manholes dry were questioned as potentially detrimental to cable cooling. But there was complete agreement about the need for further investigation.

Exclusion of Oxygen Helps . . . Complete exclusion of oxygen would greatly extend the tolerance to bending and stress of lead cable sheath, said R. W. Atkinson, L. Meyerhoff, and W. H. Cortelyou, all General Cable. Protective coverings have been found effective for short periods only.

Certain arsenical alloys demonstrate from two to four times the tolerance to bending and hoop stress of typical copper-lead. These also extend the useful life or current capability of lead-covered cable. Sheath life depends on many factors, but sheath strain is the best parameter, commented L. F. Hickernell, Anaconda. Strain measurements should be used as a reference.

Looping Saves Cable

Manhole redesign to permit looping lead-covered cable was presented by G. H. Fiedler and E. J. Nelson, Rochester Gas & Electric, as a cure for sheath cracking. This practice was adopted after conventional installations had cracked in one year. Field soldering and bandaging gave only a few weeks relief. But 3/c, 750-Mcm, 13-kv cable trained with a complete vertical loop of 34-in. radius has remained in service for 7 years.

Flexible bellows inserts in the lead sheath also promise extended sheath life, they reported. Split bellows have been applied to existing cables for field repair of cracks. This operation is more difficult than on the initial cable installation but has proven fairly successful.

Discussers supported the claim that greater radii increase sheath life, E. S. Halfmann, Philadelphia Electric, reporting that a 40-in. radius should give 20 years life where the original 24-in. offset had been short-lived. R. W. Gillette, Consolidated Edison Co of New York, observed that of otherwise identical cables one with 53-in. lay caused no trouble while another with 73-in. lay cracked repeatedly.

Fungii Destroy Rubber Insulation . . . Micro-organisms flourish in rubber-insulated cables, reported J. T. Blake, D. W. Kitchin, and O. S. Pratt, Simplex Wire & Cable Co. Fungus filaments penetrate the covering to the conductor itself in a few months. The dielectric strength is drastically impaired. Failures occurred not only in soil but also in humid air.

Substituting synthetic materials for natural rubber prolonged the useful life of the insulation. Neoprene and butyl compounds show promise of greater resistance against fungus attack, but fungitoxicity is advisable. Polyvinal chloride and polyethylene have maintained normal insulation resistance for six years.

Propose Changes in Bushing and Transformer Standards

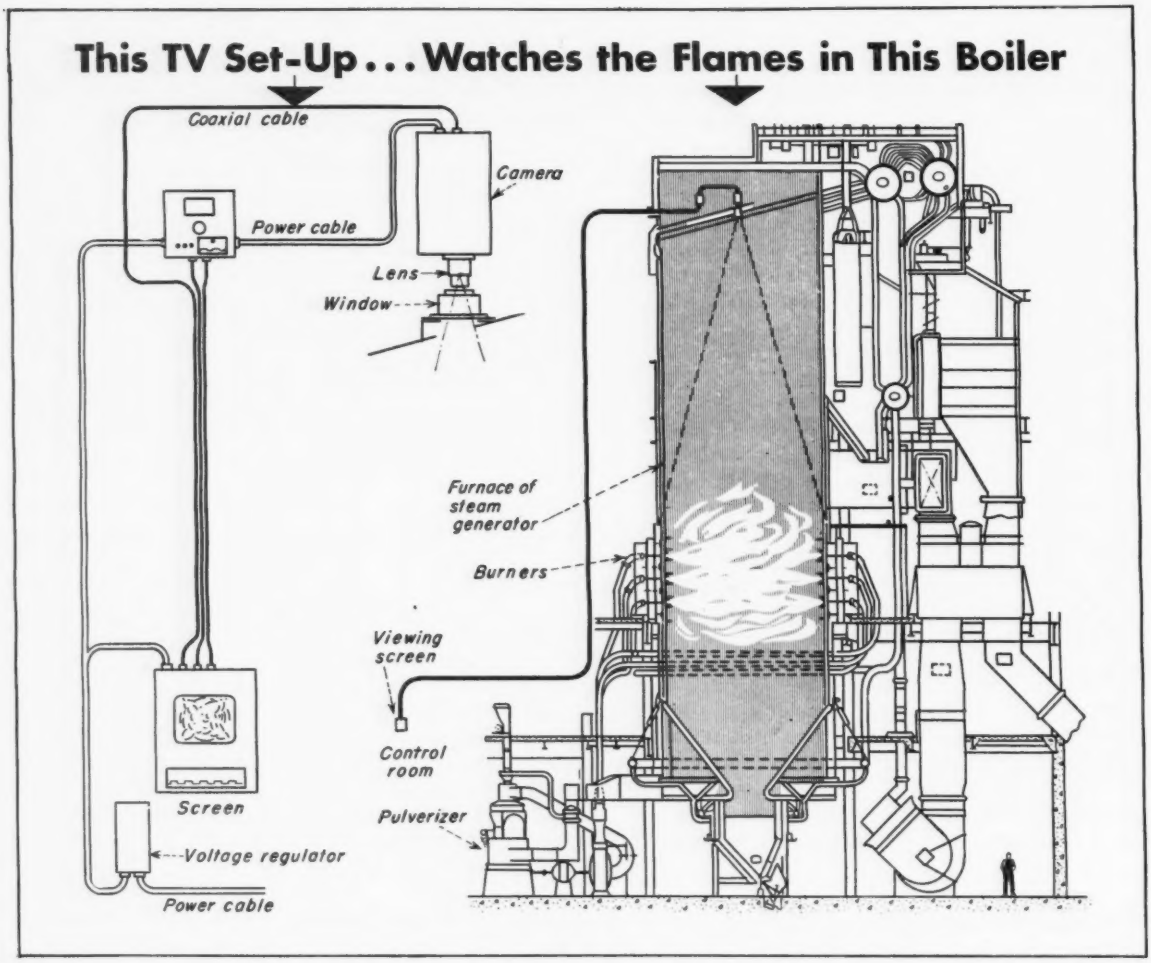
Interchangeability of bushings on transformers of different makes and between transformers and switchgear in voltage classifications of 23, 34.5, and 66 kv was proposed in a NEMA committee report. The proposed change would reduce the number of bushings for these classifications from 500 to 24 and would greatly simplify stocking by users. The proposal is to be submitted to ASA, and manufacturers will not start the expensive changes until the standard has been approved.

Discuss Dry-Type Transformers . . . Aging of dry-type transformers having different classes of insulation depends not only on temperature but on whether the transformers operate in air or in other medium such as nitrogen according to H. C. Stewart, L. C. Whitman, and A. L. Scheideler, General Electric. M. L. Manning, Pennsylvania Transformer, questioned the test methods and particularly raised the question of what happens in case of leaks in nitrogen filled units of the sealed dry type. Test results and the discussion that followed indicated that changes are in the offing in the Class A, Class B, and Class H designations for dry type transformers.

Fans for auxiliary cooling of transformers should be started at hot spot temperatures of 80 to 85 C for optimum benefits, said H. A. Fohrhaltz, General Electric. Starting at 70 C or lower causes unusual operation and

(*Continued on page* 160)

A. W. Bradt, Hamilton (Ontario) Hydro-Electric System; M. H. McGrath, General Cable Co; O. W. Titus, Canada Wire & Cable Co; and E. R. Thomas, Consolidated Edison Co of N. Y.



LOCATION OF TV CAMERA is shown in sketch. Camera lens is protected from the intense heat of the furnace by a water-cooled window

TV Pictures Combustion Conditions Inside Furnaces

Port Jefferson installation of Long Island Lighting Co enables operator to watch burning fuel from screen on control board. Operating efficiency of boilers greatly improved

L. M. EXLEY, Long Island Lighting Co, Port Jefferson, N. Y.

Combustion conditions in the furnaces of steam generators at Port Jefferson generating station of Long Island Lighting Co can be watched continuously on television screens located on the steam generator panel in the station's central control room. In this the operator has information on furnace operation by means of pictures which make this instrument a helpful aid. The objectives in developing this application of television to observe furnace conditions were these:

1. Preparatory to lighting off, that all ignition torches operated from the control room are ignited.
2. In lighting off, that ignition has taken place and is stable.
3. Malfunction of burners at any boiler rating.
4. Loss of ignition at any time.
5. Any condition that might result in a furnace explosion.
6. Combustion conditions which might result in a smoking stack.
7. Performance equally well on coal or oil.
8. Burner and combustion conditions not readily analyzed by other means.

All of these objectives have not been fully realized. Developments are outlined in subsequent paragraphs.

Television shows the conditions in both of the station's tangentially fired 425,000-lb per hr, 1,250-psi, 950-F steam generators, each served by three pulverizers. The burners are designed for firing by either oil or coal and are arranged with tilting nozzles for superheat control. Secondary air dampers and light-oil ignition torches are remotely controlled. Both steam units are operated over a range from 75,000 to 430,000 lb per hr. Each furnace serves a 50,000-kw turbogenerator.

The TV camera is mounted so the lens is over a centrally located 3-in. diam window in the furnace roof. Combustion conditions can be seen down to the burners, a distance of approximately 55 ft. The mounting is identical in the two installations which have been made.

For windows of the viewing stations, water-cooling and air-cooling systems have been developed. These stations are located at the top of the furnace near the point where the hot gases enter the superheater bank and temperature is 2,000 F. Ambient air above the furnace ranges from 32 F in winter to 110 F in summer.

In the first TV installation the camera lens is protected by a water-cooled window mounted in a chamber supplied with compressed air. Air passes through an annular opening and across the bottom glass of the water-cooled window to prevent discoloration of the furnace side of the glasses. A closed circulating system is employed. Water from a storage tank is circulated by a motor-driven pump through a small heat exchanger, through the window, and back to the tank. If the pump fails, natural circulation of the water cools the glass sufficiently to protect the camera for short time periods. A pump-motor, trip-signal alarm is installed in the control room.

In the second TV installation the camera lens is protected by an air-cooled window supplied with about 45-cfm of air at 1 psig. The window glasses can be removed, cleaned and replaced quickly and easily without use of tools or gloves.

Air is supplied by a small, positive type, motor-driven blower. In case of motor or blower failure a pressure switch, located in the discharge line of the blower, actuates an alarm in the control room and opens a solenoid valve connected to the house air system.

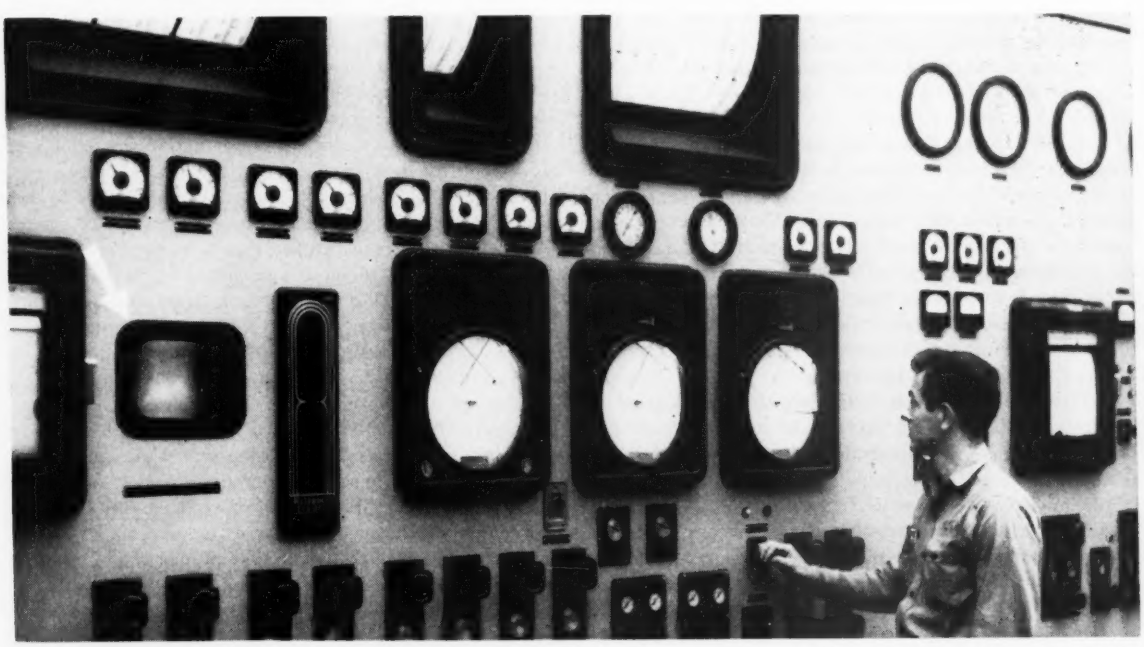
The camera will stand 150 F, but it is cooled and pressurized by a small, low-head, impeller type fan. Both the blower and the fan obtain outdoor air through a suction line that extends to the outside of the building.

Performance . . . Accompanying pictures of the television screen show performance of the equipment. They do not show all conditions or as much detail as can be seen by observing the screen directly because photographing of pictures on television screens presents many problems. For example, as boiler rating is increased light intensity increases and some of the picture detail is lost.

1. Preparatory to lighting off, the ignition torches can be seen on the screen in the control room. The four white dots in each corner of the screen, as in Fig 1, show the ignition torches.

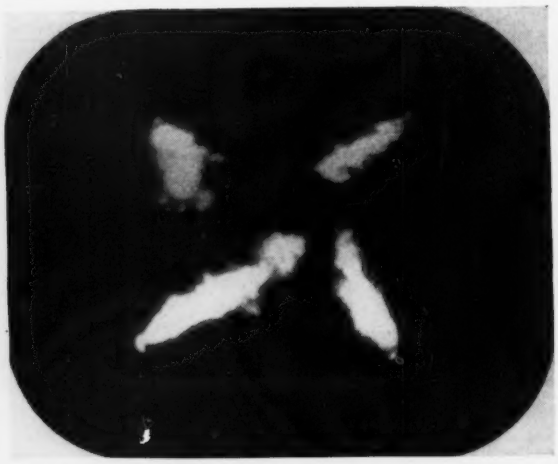
In bringing the coal-fired steam generator up to pressure from a cold start and up to the time the generator is phased in, the light-oil burners are used (Fig 2). The steam atomizing torches that are used for heavy oil are also used for light oil. The flame may appear satisfactory through the inspection doors at the burners but combustion may be unsatisfactory and cause smoking. The television screen has proven very helpful during periods of light-oil operation because the control operator can keep a constant check on the condition of the flame.

2. In lighting off pulverized coal, the screen blanks out when the fuel is first admitted to the furnace. Ignition normally takes place in about 30 sec. As this occurs the screen brightens and when proper combustion is established, the flame pattern appears on the screen and stability of ignition can be observed.



TV VIEWING SCREEN at left gives control room operator knowledge of firing sequence, flame stability, and other information of value

1 Ignition torches show up as the four white dots at the corners of viewing screen. This is view before fuel has been ignited



2 Light-oil burners bring coal-fired steam generator up to pressure from cold start and are used till generator is phased in

Flame Patterns on TV Screen Tell Their

3. During low-load operation on coal, ignition torches are operated continuously to maintain a stable fire. At ratings of 75,000-lb per hr, the operation of all four ignition torches is essential for flame stability. While burning coal at these low ratings, the light intensity is very low, (Fig 3) however, the picture is sufficiently clear to indicate furnace conditions to the operator.

4. Loss of ignition due to stoppage of oil or coal flow is shown instantaneously by a black screen. Incomplete combustion, if serious, will also cause the screen to blank out. This is because the camera is located at the top of the furnace and as unburned fuel rises it obscures the flame at the burners. In case of loss of ignition, the operator must verify this condition by observing furnace draft gauge, which always changes at loss of ignition, and pulverizer instruments in case of coal or the fuel pressure gauge in case of oil. The steam pressure gauge and steam flow meter will also help in analyzing the situation. At Port Jefferson the operator also has the flame image mirror for a positive check.

In case of a rapid decrease in air or increase of fuel resulting in a rich, explosive mixture in the furnace, the operator must also make use of the same instruments. Such conditions are usually caused by failure of combustion controls, failure of forced or induced draft fan motors, or trouble with dampers in forced or induced draft ducts. Therefore, in case of sudden changes resulting in a black screen, television indicates a serious condition, but other instruments must be checked and analyzed to determine the exact condition and the remedy.

5. However, television does provide preventative information which lessens the possibility of explosions or loss of ignition. Conditions have been observed that, if allowed to prevail until a routine furnace inspection was made, might have been more serious.

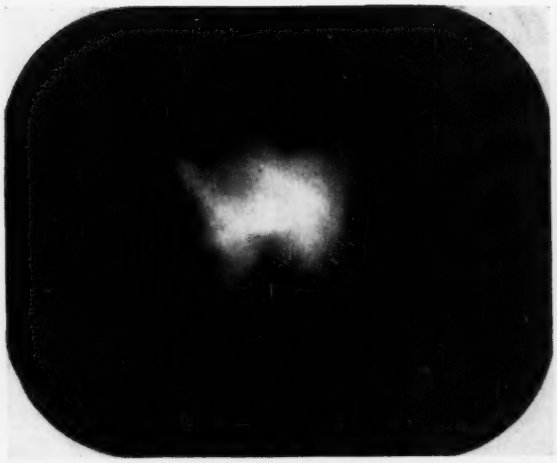
6. Television shows instantaneously, changes in the furnace that might lead to a smoking stack. Any appreciable reduction in air for combustion lowers the secondary air velocity, which affects the flame pattern appearing on the screen. When air is reduced to a point that there is incomplete combustion, tails of smoke can be distinguished around the burners and only the center of the screen is bright. If air is further reduced, the bright area in the center of the screen eventually becomes dark. This information is helpful in maintaining a clear stack.

7. Television has proven helpful in analyzing burner conditions. For example, before television was installed, during burner cleaning on oil firing, dark puffs were usually observed from the stack. At that time it was concluded that the operators were cutting the oil burners back in service too quickly. Television showed that the dark stack was caused by purging the burners too rapidly. With a picture of the furnace before the operators, it was found that in burning high volatile coal the point of ignition could be kept further away from the burners than was previously considered practical. Coking of burners does not show, but any condition affecting flame pattern is readily observed.

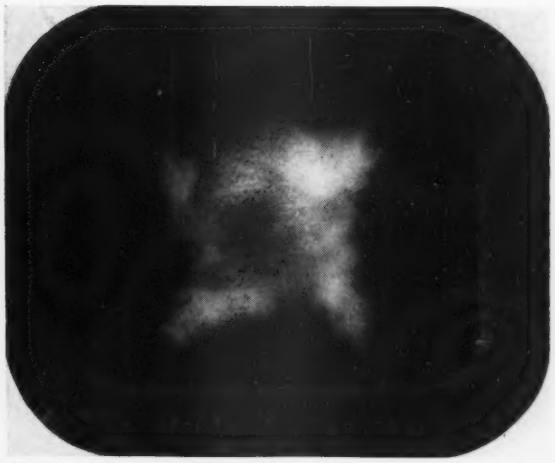
8. During rapid changes of steam output, associated with plant or system troubles, an analysis of conditions in the furnace by instruments is very difficult. In one such case, television proved helpful. This was before the flame indicating mirror was installed on this unit. Because of a partial loss of condenser vacuum, it was necessary to drop load quickly. Two pulverizers were taken out of service. The television screen blanked out; furnace pressure gauge and all other instruments were changing because of the rapid load drop. The operator was afraid that he had lost ignition and was on the verge of tripping out the one pulverizer when a picture of the flame appeared on the television screen. As the vacuum recovered immediately, no time was lost in picking up load.

Failure of secondary air and burner tilt controls have been first noticed on the television screen in several cases. It is very difficult to see this condition through the furnace observation doors at high loads, while at low loads the burner on which the trouble exists may be out of service. Another point of interest is that falling slag can be observed during the blowing of water wall soot blowers.

At Port Jefferson the furnace design, size, and method of firing provide an ideal application. While satisfactory results have been obtained with coal firing, the picture is



3 Light intensity in furnace is extremely low at 75,000-lb per hour boiler output when pulverized coal is being used as fuel



4 Flame appearance and the light intensity both improve as steam generator output is raised from 75,000 to 150,000 lb per hour

Story to Operator

much clearer on oil firing. In order to obtain a clear picture at low loads, the window under the camera must be clean. Therefore, the window is very important from the standpoint of operating results as well as camera protection. The television equipment must also be properly maintained to assure reliable operation.

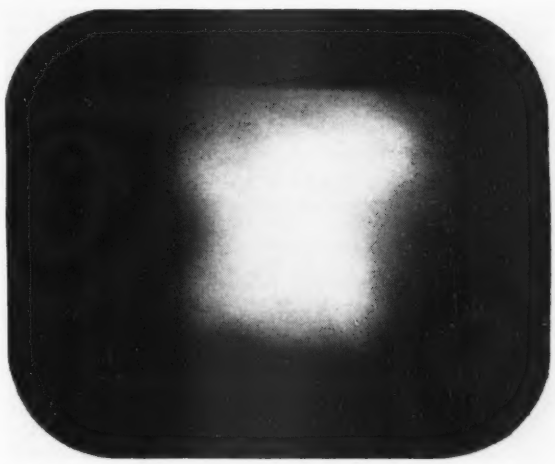
Maintenance . . . Electrical maintenance on the unit that has been in service since April 1951 has been nominal. There have been no failures of camera or picture tubes. Maintenance has consisted principally of testing and replacing 12 electronic tubes which cost approximately $2.50 each. Some time has been required for adjustment of camera and monitor, the major part of which was spent on adjusting focus coil for the picture tube.

At first electricians were not too successful in maintaining this equipment. However, they have now become familiar with it and perform routine maintenance and adjustments satisfactorily. Based on present experience it is expected that a preventive maintenance inspection every three months will keep these units in satisfactory operation. The company has no information from which to estimate the life of the large tubes or of the complete unit.

The second unit developed some troubles which were attributable to the development of an air-cooled window. As this unit has not been in service continuously, an analysis of maintenance is difficult.

Conclusions . . . Television at Port Jefferson has proven a helpful operating aid and does give a more complete story of furnace conditions than has been made available by any other means. It has limitations which are comparable to the limitations of the human eye because it cannot distinguish between thick smoke, dust clouds, or an unlighted furnace. Installation of the flame indicating mirror has been helpful in this respect.

Television also has had an educational value. In establishing operating procedures, and also in training men, instructions have to be transcribed to operators who have had very little opportunity to visualize conditions in the furnace. With a picture in the control room, all the operators have become familiar with the mechanics of tangential firing, effects of secondary air and burner tilts, putting on and taking off pulverizers, etc. Now they have a much better understanding of what takes place in the furnace than would otherwise be possible.



5 Picture detail is not quite so distinct at boiler load of 425,000 lb per hour. Picture is much clearer when oil is the fuel

Television is helpful also in counteracting one of the disadvantages of remote centralization of steam generator instruments. A picture of the furnace gives the operator a greater sense of reality with respect to the tremendous amount of energy under his control. This had a tendency to be lost in a centralized control room where the operator does not even observe a furnace puff.

Furnace design, size, and method of firing at Port Jefferson provide physical conditions well adapted to the application of television. The information to be obtained from the application of television, for direct viewing of furnaces, depends to a great extent on the availability of a good vantage point for the location of the camera. From company experience, if an opening is located where desired conditions can be observed by the eye, the camera will reproduce the same conditions on the monitor screen.

PUBLIC RELATIONS & ADVERTISING

One Way of Proving an Old Claim

Whenever a new street lighting system is installed, the claim is usually made that the lights are bright enough to read a newspaper by. This claim was made when Mattoon, Ill., turned on its new system. But George Pendell, executive secretary of the Association of Commerce, challenged it.

He got Police Captain Ed Horn to throw up a road block at a street intersection. Then suitably seated they tested the lights, found the claim was valid.

Ohio Edison System Men Win 15 Display Awards

Displaymen of Ohio Edison Co and its subsidiary, Pennsylvania Power Co, recently set a record when they captured 15 of a possible 45 prizes in an international contest. The utilitymen not only competed against those from other utilities but from department stores and other retail establishments. Display programs of both companies are supervised by George W. Westerman.

The annual contest is sponsored by "Display World," a publication devoted to the efforts, accomplishments, and ideals of the display profession. There were 3,104 entries from 48 states and many foreign countries.

Leader of the Ohio Edison System was Joseph Hoogerhyde of the Akron Division. In a point-rating system for individuals, he ranked fifth in the world-wide rating. He was awarded first prize for displays on ranges and another for laundry equipment. He won three seconds, one for major appliances, a second for small appliances, and a third for refrigeration. His two thirds were for lamps and for Valentine Day displays.

Otto Pearsall, Pennsylvania Power Co, received a first for refrigeration and another for major appliances. He got a third place for Christmas interiors.

Stan Dahlmann, Edison's Springfield Division, received seconds for Thanksgiving Day displays and Christmas exteriors and a third for refrigeration.

Cliff Griffin, Edison's Youngstown Division, got thirds for major appliances and ranges.

PIP Reduces Fees 5% to Smaller Companies

With increased support provided by additional participating companies, the Electric Companies Public Information Program has announced a cut of 5% in the schedule of fees needed to carry on the program in 1953. The cut was accomplished by a reduction in the minimum fee for small companies to broaden the grass roots base of participation in PIP activities.

PIP fees for 1953 are graduated between the new minimum of $35 and a maximum of $600 per month, computed on the basis of annual gross electric revenue in 1951. Companies at the maximum level are not affected by the discount.

Exchange of Old Lamps Improves TV Reception

When a TV serviceman traced a case of interference with television reception to a pre-1927 tungsten filament lamp and discovered that the lamp was causing interference on all sets in an area of three blocks, he reported it to the Cedar Rapids "Gazette" and to the Iowa Electric Light & Power Co.

The newspaper ran several stories describing the TV interference caused by the bulbs and pictured the interference pattern and the bulbs causing it. The utility took an advertisement offering free exchange of the troublemakers for new bulbs. Nearly 500 bulbs were exchanged.

2nd 'Finer Carolina' Contest Draws 108 Towns

Carolina Power & Light Co's second "Finer Carolina" contest has attracted 108 towns, 91 from North and 17 from South Carolina. Awards of $1,000 for first place, $500 for second, and $250 for third will go to the winners in three different classifications by population. In addition there will be 15 "honorable mention" awards of $100 each.

The 1953 contest has been expanded to include additional prizes for soil and water conservation practices on the farm. A $500 prize will go to the county entering the largest acreage in the contest, and another $500 will go to the county entering the largest percentage of its total acreage.

Individual farmers will receive three sets of prizes of $300 for first place, $200 for second, and $100 for third in three acreage groups: farms of 50 acres or less, 50-100 acres, and over 100 acres.

Handing Out 'Magic Oil'

Interstate Power Co has prepared little jugs of "Magic Oil of Customer Relations" to go on the desks of all employees. The die-cut jug when opened will stand alone. Each side carries the message that the "Magic Oil of Customer Relations" consists of (1) Interest in the customer, (2) Courtesy, (3) Personal Appearance, and (4) Look Pleasant.

WASHINGTON COMMENT

JESSE MOCK

Natural Resources Policy Conference Delayed Until Fall

The boom has been lowered on a big-time natural resources policy conference which had been set for March 25 in Washington under the tentative name, "White House Conference on Resources for the Future."

Letters announcing postponement till fall are now being sent out by Resources for the Future, Inc, which was to organize and sponsor the conference single-handedly. It's a good bet the conference to be held in the fall won't be the same one that was planned for March.

Delay of the conference may well have averted an acute embarrassment to the Eisenhower administration and thwarted one of the most ironical stunts ever planned for presentation on the Washington political stage.

An Opportunity for Propaganda . . . If all had gone as planned, some Washington observers believe the conference would have been one vast propaganda effort to revive the New and Fair Deal policies on natural resources development—all with the apparent backing of the new Republican administration. With the delay the new administration will have a fairer chance to present its own views on controversial aspects of natural resources development problems when the conference is held.

This is the way the conference was shaping up when opposition forced the postponement:

During the presidential campaign, conference planners contacted the two major candidates and received assurances of cooperation from both. Candidate Eisenhower wrote Resources for the Future officials he would call or join in calling the conference and voiced enthusiastic approval.

By the time the planners were ready to issue their first public announcement Nov. 13, it was emphasized that close White House cooperation was assured. By Nov. 24, the conference had been dubbed "White House Conference on Resources for the Future."

But these announcements, too, named Charles W. Eliot, an old New Deal planner, as executive director of Resources for the Future. This meant he would be in the driver's seat in organizing and conducting the conference. Eliot, Washingtonians remembered, was also working head of National Resources Planning Board. This was the board which did much of the New Deal planning in the thirties and which was a frequent target of Republican and conservative Democratic lawmakers.

Congress finally managed to scuttle NRPB in 1943 after Sen Robert A. Taft, now Republican floor leader, had accused the Board of following a line "which appears to be partly socialistic and partly the product of a dangerous financial imagination."

What NRPB Stood For . . . That same year, an NRPB report had suggested creation of "a national agency or corporation authorized specifically to guide the development and use of electric power in the public interest . . . through subsidiaries it might act as a joint owner in co-partnership with other public bodies and even with private groups, where and as indicated by the public interest in each area."

On the board of directors of Resources for the Future were such New Dealers as Stanley Ruttenberg, director of education and research for the CIO, and Beardsley Ruml, who was a fund raiser for the Democratic National Committee during last fall's presidential campaign.

The conference was to be set up in sections such as "energy," "water use patterns," and "minerals." Basic working paper for each section would be prepared by the staff of Resources for the Future and would become the chairman's paper. This would seem to give the planners an initial advantage in getting their views across.

There were a number of other aspects of the conference which business and professional groups did not like. U. S. Chamber of Commerce charged the conference was to be run by old-line New Deal planners and professional conservationists, to the exclusion of businessmen.

The rub came when the planners asked for White House approval in sending out invitations. Eisenhower advisers stalled when they took a second look at the conference plans.

Nobody knows exactly who was most responsible for delaying the conference, but a good many people breathed a sigh of relief when the postponement was announced. It means that Eliot will not be able to continue as executive director. It also means the conference is now going out after broader sponsorship.

More important, it means the new Republican administration will have a chance to get its feet on the ground by the time the conference is held in the fall.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Adjustable speed fluid drive is accomplished by changing the volume of oil in the working hydraulic circuit. Automotive transmissions usually have a fixed oil volume.

Ash content and its composition disclose whether a particular fuel oil is safe to use in a gas turbine.

Force-cooled transformers were originally conceived for base-load operation at attended substations. Short-time rating with auxiliaries out of commission is an afterthought.

Potassium treatment is generally effective in preventing silica formation in the boiler but ineffective in preventing water-insoluble deposits in high pressure turbines.

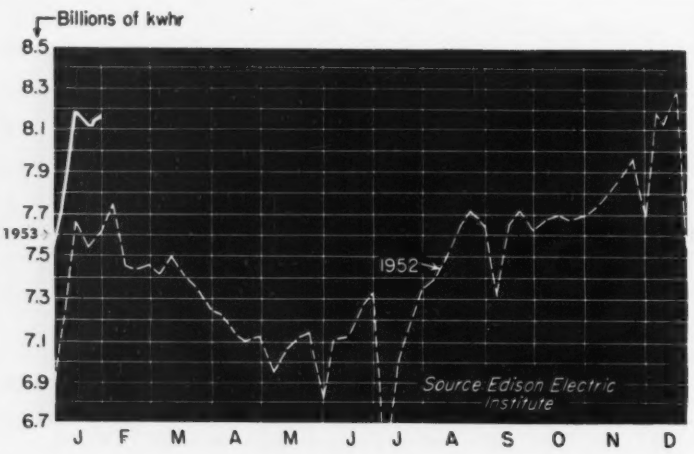
Operators who know little of what goes on inside a boiler furnace can learn easily if they are given television to watch the process.

Buzzing at top speed 414,383 horseflies can, the experimental biologists say, work at the rate of one horsepower. The horses knew that long ago.

Good plant housekeeping calls for putting tools away in orderly arrangement, cleaning up trash and spilled coal (particularly around the bunkers) and placing dirty and oily rags into safe containers.

Creosote and coal-tar consumption for wood preservation in 1951 increased 9%; increased usages among the solids were these: pentachlorophenol 33%, Wolman salts 29%, copperized chromated zinc chloride 150%, Minalith 250%.

STATISTICS



Output Week Ended Jan. 31—8,150,534,000 Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Jan. 31	+7.6	+8.9	+6.0	+8.9	+7.1	+10.1	+5.4	+9.6	−0.1	+8.9
Jan. 24	+6.9	+8.1	+5.6	+8.8	+7.5	+10.6	+7.4	+8.9	−9.1	+7.1
Jan. 17	+7.7	+10.0	+6.2	+10.2	+10.4	+15.6	+6.1	+4.0	−14.8	+4.9

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	Nov.	72.8*	71.1	68.7
Capacity (Million Kw)	Nov.	80.91	79.70	75.18
Production (Billion Kwhr)	Nov.	33.75	34.82	32.10
Hydro		6.52	7.02	8.08
Fuel		27.23	27.80	24.02
Fuel Consumption				
Coal (Million Tons)	Nov.	9.93	9.92	9.74
Oil (Million Barrels)		7.75	7.16	5.96
Gas (Billion Cu Ft)		69.94	83.08	53.15
Sales (Billion Kwhr)	Nov.	30.08	30.15	27.92
Residential		8.16	7.72	7.37
Commercial		5.01	5.09	4.70
Industrial		14.91	15.16	13.89
Other		2.01	2.17	1.97
Net Income Class A & B Companies ($ Million)	Nov.	79.81**	64.86**	69.92
Estimated Dec. 52 Peak (Million Kw)	Nov.	79.2	79.1	80.7
Kwhr per Residential Customer (12 Month Average)	Oct.	2,143	2,131	1,972
Revenue per Kwhr Residential Service (12 Month Average)	Oct.	2.77¢	2.77¢	2.83¢
Canadian Production (Billion Kwhr)	Nov.	5.22	5.42	4.94

Business Statistics

FRB Industrial Production Index†††	Dec.	233*	235**	217
Gross National Product Annual Rate ($ Billion)	3rd Qtr.	343.4	342.6	337.1
E. W. 5 Industry Production Index	Dec.	128.5*	128.5	124.6
ENR Construction Cost Index††	Jan.	123.1	123.2	114.8
BLS Consumer's Price Index	Nov.	191.1	190.9	188.6
NEMA Insulation Materials Sales Index†	Nov.	579	599	511
NEMA Electric Appliance Sales Index†	Nov.	251	260	269
NEMA Household Refrig. Sales Index†	Nov.	152	122	87
Metal prices (Jan. 28)				
Copper, Conn. V., lb		$ .24½	$ .24½	$ .24½
Lead, N. Y., lb		.14	.14½	.19
Zinc, prime Western E. St. Louis, lb.		.12	.12½	.19½
Tin, Straits, qual. N. Y. lb		1.21½	1.21½	1.03
Aluminum, ingot, base price		.20	.20	.19
Nickel, base price		.56½	.56½	.56½
Steel, billets, Pitts., ton		59.00	59.00	56.00
Steel, scrap, No. 1 heavy, Pitts., ton		45.00	45.00	45.00

* Preliminary ** Revised † 1936=100 †† 1949=100 ††† Unadjusted

Power Growth Triple All Industry Average

Electrical power production has been growing three times as fast as the average for all industries, or close to 10% annually since 1900.

The Department of Commerce in a report just published in its Survey of Current Business points out that there has been a wide variation in growth among products and industries from the immediate postwar period to the present.

Here are the nation's rapidly growing industries—those having averaging annual increases at an annual rate of 7½% or more.

Rapidly Growing Industries
Average Annual Rate of Growth—% 1940—1951

Antibiotics	118.0
Television sets	113.2
Freezers, farm and home	71.0
Dryers, clothes	70.9
Synthetic rubber, all types	67.5
Air ton-miles flown	45.6
Air conditioning units, room	42.5
Synthetic detergents (soap)	41.4
Man-made fibers, other than rayon	40.5
Disposals, waste, food	35.3
Blankets, electric	30.1
Locomotives, Diesel-electric, installations, Class I railroads	25.6
Revenue passenger-miles flown	23.8
Plastics and resin materials	21.8
Dishwashers	21.4
Magnesium	18.5
Concrete blocks	18.2
Frozen foods	17.5
Warm-air furnaces, oil and gas	17.5
Nitric acid	15.7
Trailer coaches, housing type	15.7
Repairs, household durables	15.7
Ammonia, synthetic, anhydrous	15.7
Kitchen cabinets, steel	14.7
Acetic anhydride	14.2
Water heaters, electric and gas	13.7
Methanol, synethic	13.7
Aluminum, primary ingots	13.6
Chlorine gas	13.2
Industrial trucks and tractors, electric	12.9
Hydrochloric acid	12.1
Canned juices, fruit	12.0
Phosphoric acid	11.4
Oleomargarine	11.3
Cleaning and dyeing	11.0
Ranges, electric	10.9
Gypsum board, including lath	10.6
Tractors, all types	9.8
Natural gas	9.7
Rayon and acetate	9.6
Acetic acid, synthetic and natural	9.5
Motor truck transportation	9.1
Oil burners, residential	9.1
Sodium hydroxide	8.9
Truck trailers	8.7
Softwood plywood	8.6
Calcium carbide	8.6
Shavers, electric	8.5
Fertilizers, commercial	8.3
Electric power, utilities and industrial	**8.2**
Sulphuric acid	8.2
Telephone service	8.2
Domestic water systems	8.2
Calcined gypsum	7.7
Repairs, passenger cars and trucks	7.6
Cigarettes	7.6
Motor courts, rental units	7.6
Asphalt	7.6
Paperboard, incl. wet and building board	7.5
Washing machines	7.5

FINANCIAL

Record Securities Issued in '52

Utilities raised $1.7 billion in new money last year to finance a part of their extensive construction programs

The electric industry went to the market in 1952 for a total of $1.7 billion in new money—a record high. Of this amount $1.5 billion was readily raised through public offerings of securities as shown in the table below and $200 million through private placements.

Record Construction Program Met . . . These funds together with $800 million of internal cash provided the $2.5 billion invested in new plant in 1952. Debt securities represented 65% of the funds acquired from outside sources.

In the debt market, the development of greatest significance was that long-term Treasury bonds fell to their lowest levels since issuance in 1945. At the end of 1952 they were selling at prices to yield as much as 2.81%.

As a direct result of the Treasury-Federal Reserve "accord" in March 1951, the Reserve System no longer purchases government securities to keep them at fixed prices. For the first year since the early part of World War II interest rates reflected more substantially the law of supply and demand.

Bond Rates May Ease . . . Some financial observers are of the opinion that bond rates will continue at their present level or perhaps ease a little in view of tapering off of new money demands by industry on the one hand and the continuation of the present upward trend in savings on the other.

The life insurance companies continue to be the dominant factor in the bond market and will have a cash flow approximating $7 billion for investment this year. Treasury Department policy toward debt management and the possibility of a substitution of longer term debt for the great amount of short term debt is another factor.

Proceeds from sales of preferred stock issues accounted for 12% of the funds raised last year by the industry. There were 18 companies offering 19 of these issues to the public. Of these, nine reached investors through competitive channels while ten were sold to underwriters through negotiation. In addition five companies sold new preferred stock directly to institutions for new money purposes.

Common Stock Sales of 23% . . . Proceeds from the sale of common stock contributed 23% of last year's money requirements. Sales aggregating $435.5 million were divided into 56 offerings by electric utilities themselves for $421.9 million and three offerings of stock by others totaling $13.6 million. Of the new share sales, 36 were first offered to stockholders and 20 were sold directly to the public. Nearly half of the rights offerings carried an oversubscription privilege, a technique initiated by Southwestern Public Service in early 1947.

Four companies undertook their common stock financing with no outside aid, three of which provided for an oversubscription choice and each received requests for more than 150% of the shares available. The fourth, Cleveland Electric Illuminating Co, sold stock to its stockholders through its own organization at a price some 9 points below the market and received a good 99% response.

Regulatory Commissions Show Interest . . . Probably the most constructive development during 1952 was the increasing recognition by regulatory authorities that readjustments in rates were necessary to attract capital and keep the industry in a sound position. The 1952 Report of Committee on Corporate Finance of the National Association of Railroad and Utilities Commissioners said "Utility rate increases are far below the general increases in wages, incomes and other prices . . . Similarly a wide gap has developed between general price, wage and income levels and the level of utility rates. The commissions have been industrious in keeping rate increases to modest proportions—perhaps too much so—as is evidenced by many repeats in applications. What might have to be done ratewise in order that the utilities will continue to be able to obtain the new capital needed on reasonable terms will still be far below the increase in general prices. The assurance of the ability to raise capital is, of course, vital to the public interest."

Common Stock Earnings to Improve . . . Earnings available for common stock are expected to improve during 1953 over 1952 offset, of course, by a larger number of common shares to be outstanding. Man-

Public Offerings—Electric Utility Securities

(Thousands of Dollars)

	1952			1951		
	New Money	Other	Total	New Money	Other	Total
Bonds, Notes, and Debentures	920,043	.....	920,043	766,356	14,359	780,715
Preferred Stocks	189,875	.....	189,875	165,965	10,000	175,965
Common Stocks (a)	421,920	13,570	435,490	345,364	4,324	349,688
Total	**1,531,838**	**13,570**	**1,545,408**	**1,277,685**	**28,683**	**1,306,368**
	First Quarter			**First Quarter**		
Bonds, Notes, and Debentures	295,800	.....	295,800	238,634	9,866	248,500
Preferred Stocks	60,983	.....	60,983	23,660	.....	23,660
Common Stocks (a)	80,347	5,601	85,948	120,585	.....	120,585
Total	**437,130**	**5,601**	**442,731**	**382,879**	**9,866**	**392,745**
	Second Quarter			**Second Quarter**		
Bonds, Notes, and Debentures	341,759	.....	341,759	221,600	.....	221,600
Preferred Stocks	46,885	.....	46,885	2,000	.....	2,000
Common Stocks (a)	249,239	.....	249,239	106,104	.....	106,104
Total	**637,883**	.....	**637,883**	**329,704**	.....	**329,704**
	Third Quarter			**Third Quarter**		
Bonds, Notes, and Debentures	134,000	.....	134,000	78,000	.....	78,000
Preferred Stocks	46,180	.....	46,180	2,224	.....	2,224
Common Stocks (a)	44,663	.....	44,663	36,984	4,154	41,138
Total	**224,843**	.....	**224,843**	**117,208**	**4,154**	**121,362**
	Fourth Quarter			**Fourth Quarter**		
Bonds, Notes, and Debentures	148,484	.....	148,484	228,122	4,493	232,615
Preferred Stocks	35,827	.....	35,827	138,081	10,000	148,081
Common Stocks (a)	47,671	7,969	55,640	81,691	170	81,861
Total	**231,982**	**7,969**	**239,951**	**447,894**	**14,663**	**462,557**

Source: Reis & Chandler, Inc.
Notes—Bonds are taken at principal amount and stocks at the price to the public. (a) Offerings to stockholders under subscription rights are included in same quarter as the date of stock record.

agement continues to vote more liberal common stock dividend payments. During 1952 there were 38 companies with common stocks in public hands which increased their dividend. It is recognized that such steps are not only fair but also necessary to assist in the financing of the substantial construction program of the electric industry now underway.

Pennsylvania P&L Seeks to Acquire Scranton Firm

Pennsylvania Power & Light Co has made an offer to acquire Scranton Electric Co, according to a joint announcement by Charles E. Oakes, president of Pennsylvania P&L and C. F. Nagle, president of Scranton Electric.

Pennsylvania P&L proposed the following stock exchange:

1. One share of PP&L common stock for each two shares of Scranton common stock.

2. One share of PP&L 4.40% series preferred stock for each share of Scranton 4.40% series preferred stock.

3. Three-fourths of a share of PP&L 4½% preferred stock, or as an alternative, two shares of PP&L common stock for each share of Scranton 3.35% series preferred stock.

At least 80% of Scranton Electric common and preferred stock must be acquired by PP&L to make the offer effective, the statement said, but PP&L may lower the percentage requirement if it chooses to do so.

Two Iowa Utilities Plan Merger by Stock Transfer

Directors of the Iowa Electric Co and Iowa Electric Light & Power Co have announced plans of merging by an exchange of stock.

Sutherland C. Dows, president of both companies, said the stock will be exchanged on the following basis:

1. Each share of 6½% preferred stock of Iowa Electric will get 8.4 shares of Iowa EL&P common stock.

2. Each share of Iowa Electric 7% preferred will get 8.8 shares of Iowa EL&P common stock.

3. Each share of Iowa Electric common will get four shares of Iowa EL&P common stock.

Stockholders' meetings of both companies have been called for April 7 at Cedar Rapids.

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1953									
Jan. 29	**3.05**	**3.09**	**3.18**	**4.10**	**4.27**	**4.58**	**4.95**	**5.31**	**5.65**
Jan. 22	3.04	3.08	3.18	4.12	4.29	4.59	5.01	5.40	5.64
END OF QTR:									
4th 1952	2.99	3.03	3.14	4.06	4.22	4.59	4.98	5.33	5.62
3rd 1952	2.99	3.03	3.16	4.10	4.26	4.61	5.18	5.59	5.96
2nd 1952	2.95	3.00	3.09	4.05	4.31	4.60	5.38	5.85	6.42
1st 1952	2.95	2.99	3.13	4.11	4.29	4.66	5.35	6.03	6.47

Data: Reis & Chandler, Inc.

EARNINGS—Preliminary

Company	Period Months Ended		Net Income 1952	Net Income 1951	Earnings Per Common Share 1952	Earnings Per Common Share 1951
Consolidated Gas Electric Light & Power of Baltimore	12	Dec.	$10,139,982	$9,335,310	$1.81	$1.69
Florida Power & Light	12	Dec.	7,621,653	6,706,731	2.84	2.50
Houston Lighting & Power	12	Dec.	8,846,537	6,972,517	....	....
Minnesota Power & Light	12	Dec.	3,382,860	3,320,851	3.27	3.19
New York State Electric & Gas	12	Dec.	7,477,155	6,290,246	2.38(a)	2.18(a)
Ohio Edison and subsidiary	12	Dec.	16,191,616	13,887,228	2.97(b)	2.60(b)
Oklahoma Gas & Electric	12	Dec.	5,706,889	4,960,403	2.00	1.69
Pennsylvania Power	12	Dec.	2,203,647	1,794,345	....	....
Southern Co—consolidated	12	Dec.	20,232,110	16,904,728	1.18	1.03
Southern Indiana Gas & Electric	12	Dec.	1,879,968	1,688,306	2.14	1.86
Tampa Electric	12	Dec.	2,262,895	1,746,745	3.39(c)	2.92(c)

Notes—(a) Based on 2,696,950 shares in 1952 and 2,396,950 shares in 1951; (b) Based on 4,798,460 shares in 1952 and 1951; and (c) Based on 631,776 shares in 1952 and 598,441 shares in 1951.

FINANCING

Company and Description	Amount of Offering ($000)	Offering Price	Yield to Public
WEEK OF JANUARY 29—FEBRUARY 4			
Bonds			
Jacksonville, Fla., electric system	$18,000	various	1.20–2.75%
Southwestern Public Service—1st mtg 3½% due 1978	12,000	$101.00	4.60
Preferred Stock			
Southwestern Public Service—20,000 sh 4.60% $100 par	$2,000	$100.00	4.60%
Illinois Power—150,000 sh 4.42% $50 par	7,500	51.00	4.33
Common Stock			
Southwestern Public Service—293,462 sh (being offered to commonholders on 1-for-12 basis, record Feb. 2 to expire Feb. 17; stockholders are allowed oversubscription privileges)	$6,309	$21.50	5.58%
Louisville Gas & Electric—200,000 sh (being offered commonholders on 1-for-7 basis, record Jan. 29 to expire Feb. 17)	7,300	36.50	4.93
SCHEDULE FOR FEBRUARY—MARCH—APRIL			
Bonds			**Bid Date**
Iowa Southern Utilities—1st mtg	$7,000	.....	Feb. 17
Consolidated Edison Co of New York—1st mtg	40,000	.....	Feb. 17
Niagara Mohawk Power—1st mtg	25,000	.....	Feb. 18
Mississippi Power & Light—1st mtg	12,000	.....	Mar. 17
Georgia Power—1st mtg	16,000	.....	Mar. 24
Florida Power & Light—1st mtg	15,000	.....	April 7
California Electric Power—1st mtg	8,000	.....	April 7
Fall River Electric Light—1st mtg 1983	6,800	.....	.....
Preferred Stock			
Georgia Power—100,000 sh no par	.....	.....	Mar. 24
Texas Electric Service	8,000	.....	April 13
Common Stock			
Niagara Mohawk Power—1,000,000 sh	.....	.....	Feb. 16
California Electric Power—136,000 shs	.....	.....	Mar. 31
South Carolina Electric & Gas—358,045 shs (to be offered to commonholders on 1-for-7 basis, record Feb. 17 to expire Mar. 4; stockholders to be allowed oversubscription privileges)	.....	.....	.....
Southern Indiana Gas & Electric—114,167 sh (to be offered to commonholders on 1-for-6 basis, record Mar. 25 to expire April 10)	.....	.....	.....
UNSCHEDULED AND UNDER CONSIDERATION			
Bonds			
Central Maine Power—1st general mtg	$10,000	.....	.....
Wisconsin Public Service—1st mtg	7,500*	.....	.....
Public Service Electric & Gas	50,000	.....	.....
Alabama Power—1st mtg	18,000	.....	.....
Gulf Power—1st mtg	7,000	.....	.....
Common Stock			
Gulf States Utilities	$6,000	.....	.....
Public Service Electric & Gas—750,000 sh	.....	.....	.....
Southern Co—about 1 million sh (to be offered to commonholders on 1-for-17 basis, record about April 16 to expire May 7)	.....	.....	.....
Arizona Public Service—400,000 sh	.....	.....	.....

Notes—*Estimated.

Report Favors Overhead Lines

Engineers hired by California legislature call high voltage circuit 'necessary' to meet needs of San Fernando Valley

Legislative indignation over plans of the Los Angeles Department of Water and Power to construct overhead high tension transmission lines in the West San Fernando Valley is expected to collapse as a result of a report by two engineers hired to investigate the project.

Residents of the area favored an underground system and had carried their fight to the California legislature which two years ago instructed one of its committees to conduct an investigation of the department's plan.

Submit Report . . . The committee hired Gilbert D. McCann and Royal W. Sorensen, professors of electrical engineering at the California Institute of Technology, Pasadena, to prepare a report. The report has been submitted to the legislature by the assembly interim committee on public utilities and corporations.

"The over-all plan developed by the department of establishing a large receiving station in the western portion of the San Fernando Valley fed by high voltage transmission circuits is a necessary addition to the power system," the engineers' report concluded, "and offers less disturbance to the owners than the use of the 34-kv circuits feeding into the area from a station outside the area. The ultimate required number of such lower voltage circuits would be very great and provide unsatisfactory service."

The need for this expanded program, the report adds, is such that it should be started very soon.

McCann and Sorensen point out the department based its planning on the premise that overhead transmission circuits rather than underground would be used.

Following Established Policy . . . "This is consistent with its established policy and those of other utilities in this country for areas having the general population density and property values prevailing at present in the valley area planned for the right of way," the engineers reported.

"If the system had been planned for underground transmission circuits it is probable that the cost differential between overhead and underground construction would be about $14 million instead of $18 million. (The overhead system cost is set at $11 million by the department while the underground cables would approximate $29 million in cost.)

"This cost differential is the principal factor affecting the owners' desire for underground construction. It is not within the scope of this report to discuss means by which this cost might be borne.

"It is perhaps in order, however, to observe that the principal factor which contributes to this issue between the owners' and the department is the rapid rate of development in the San Fernando Valley and the question as to whether the basis which should be used to determine the value of the property generally affected by the proposed transmission system should be on the present values or expected future developments."

The report is viewed as being favorable to the department's plans and there has been no evidence of any further protest movement in the legislature.

Private Development of Niagara Proposed

Private enterprise may get the nod from the 83rd Congress to develop the unused power potential at Niagara Falls.

Bills which would permit electric companies to install and operate the additional 1.1 million kw of generating capacity have been introduced in Congress. Republican Senators Edward Martin of Pennsylvania and Homer E. Capehart of Indiana offered the Senate bill. Companion bill was introduced in the House by Republican Rep William E. Miller of New York.

Sen Martin is present chairman of the Senate Public Works Committee which will consider the bill, and thus is in a position to speed its consideration.

Chairman George A. Dondero, of the House Public Works Committee, a Michigan Republican, also favors the proposed legislation.

Bills proposing federal development of the additional power at Niagara again will be introduced by Sen Herbert H. Lehman and Rep Franklin D. Roosevelt, Jr, New York Democrats.

But prospects are that Congress will not face the three-way fight which hampered the 82nd Congress in reaching a conclusion on Niagara redevelopment. There is as yet no indication that New York State will again vie for the opportunity to develop Niagara power. Sen Irving M. Ives, New York Republican who fought for state development in the previous Congress has said he has no plans to reintroduce a bill for that purpose.

Five New York companies, which serve about 90% of the customers in the state, back the Capehart-Martin-Miller bills. They are the Niagara Mohawk Power Corp, Rochester Gas & Electric Corp, Central Hudson Gas & Electric Corp, Consolidated Edison Co of New York, and New York State Electric & Gas Corp. This group is ready and willing to undertake the additional power development at the Falls.

POWER BRIEFS

● Schiller mercury-steam plant of Public Service Co of New Hampshire near Portsmouth was evacuated for a short period Jan. 20 when chlorine gas from a one-ton tank leaked into the station because of a defective valve. A few persons were hospitalized temporarily but no lives were lost. The gas was concentrated mainly in the lower part of the building. Chlorine is used to prevent mussel accumulation in the circulating water system.

● Jersey Central Power & Light Co is winner of General Public Utilities Corp President's Safety Award for 1952. The award was presented to the utility for a reduction of 94.9% in combined frequency and severity accident rate as compared with its previous five-year experience. The company's combined frequency-severity rate of .32 for 1952 is the lowest in its records.

● Work on Miguel Aleman Dam, principal structure of Mexico's Papaloapan project in Vera Cruz State, has been completed sufficiently to close the dam curtain and the diversion tunnel to start water storage behind the dam. Hydro plant at the dam will have a capacity of 105,000 hp.

R. H. HUMBERT, Manager of Marketing, Lamp Division, General Electric Co

Selling Creates the Lighting Market

In the coming ten years we can double the present amount of electricity used for lighting with benefit to all concerned

Determination to sell and keep on selling, expressed in intensified promotion and expanded effort in consumer education, will make the lighting load in 1962 double that of 1952 and equal to the entire load on utility systems in the war year of 1943. We estimate, on the basis of recent studies by our company and by a nationally-known independent survey organization, that with determined selling lighting can be pushed up to 186 billion kwhr in 1962.

This optimistic outlook rests on revised conceptions of the proportions of lighting in total system loads. In one market, residential, survey field men collected data indicating that lighting accounts for 40% of the residential load. The best previous thinking had pegged lighting at 30%, and individual guesses had ranged from 9 to 61%. With this and other new knowledge, plus a major selling effort and some sound thinking, the lighting industry can look forward to new peaks, dwarfing those of the past.

Since 85% of the large lamp business will probably continue to be accounted for by the three major markets—industrial, commercial and residential—we need concern ourselves only with the potentialities in these fields. Increases can be in two directions—horizontally and vertically. "Horizontal growth" is growth in number of potential customers. This is the lesser in importance since it is limited almost entirely to the lighting of new buildings and by increases in population. It is increase resulting from the sale of adequate lighting standards to the mass of individual customers, or "vertical growth," that we should consider, for here is the greatest potential.

That the light-consuming public of all three major markets is ready and willing, not at some indefinite future time but right now, to accept better lighting, I am positive. It was proved to my satisfaction, in the residential field particularly, by a survey begun by our company late in 1950 and completed a short time ago.

To find out what effect our booklet, "See Your Home in a New Light," had upon the people who received it, we mailed a follow-up questionnaire early

last year to a nationwide cross-section sample of 10,000 persons who had asked for a copy some months earlier. Analysis of the first 1,200 replies brought out these highlights:

1. Nearly 74% said they carried out an average of 3.6 lighting recipes each.

2. About 71% said they bought an average of 3.5 fixtures or portables, plus 5.1 light bulbs each.

3. Every time a consumer carried out one lighting recipe, he bought one fixture or portable and nearly 1.4 lamp bulbs.

4. Just under 70% selected an average of 4 recipes each that they would like to carry out in the future.

If we assume that the 852 people who said they bought some equipment were the only purchasers out of the original 10,000, the results are most gratifying. On a rule-of-thumb basis, if each purchaser paid around $10 per fixture or portable and 25¢ per light bulb, he must have spent about $36, or $10 per lighting recipe carried out.

Minimum Market Is Big

To look at this on a national scale, if a corresponding 8.5% of the owners or occupants of all wired homes could be induced to spend an equal amount, the total dollar value of portables, fixtures, and lamp bulbs bought would be close to $130 million. Put another way, the same total could be achieved if about one-third of all wired homes in the United States could be induced to carry out one light-conditioning recipe.

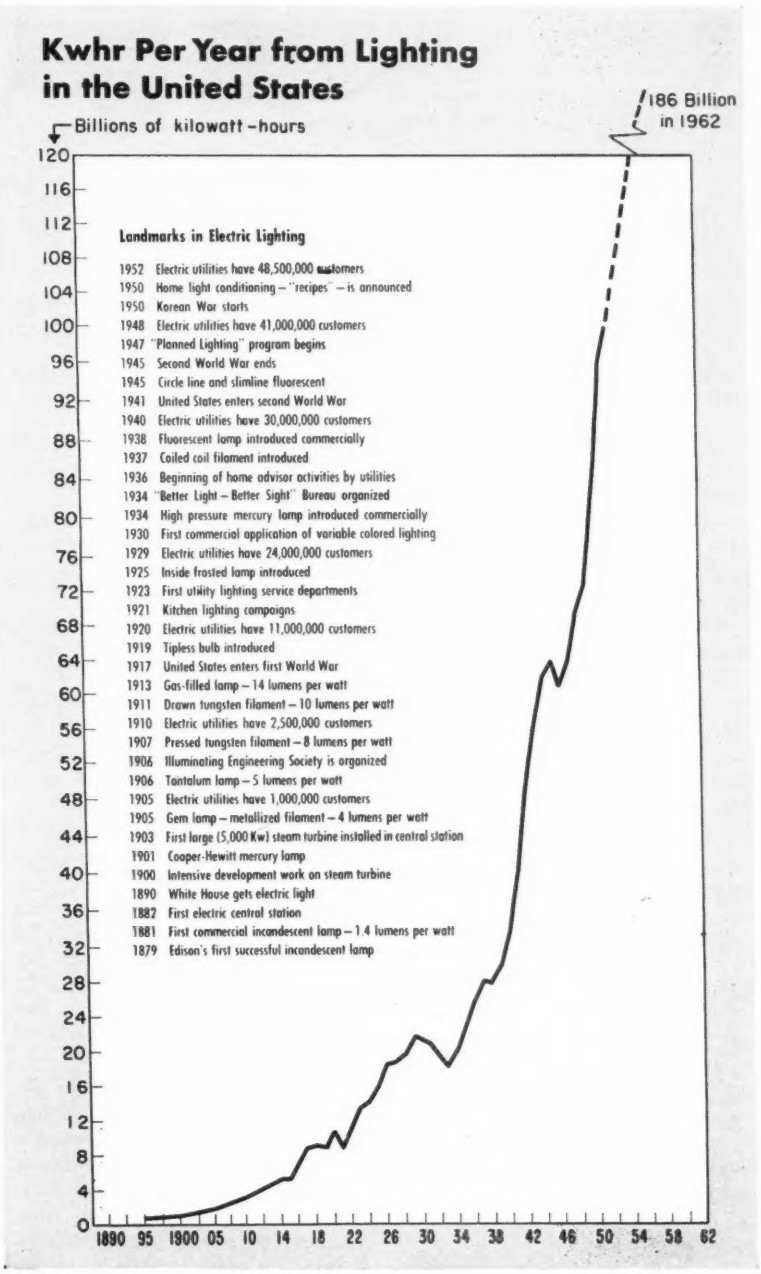
Our objectives, it seems to me, are twofold. First, and most immediate, we must plan a concentrated effort to sell the customer at least the minimum amount of adequate lighting—lighting that has been proved by experience to be in the customers' own best interest.

Second, our long-range aim must be to educate all customers on adequate lighting standards—standards which have been scientifically established and are well known in the industry. How well qualified and equipped is the industry to do that? Before we discuss this question, let's briefly see how well we have done up until now.

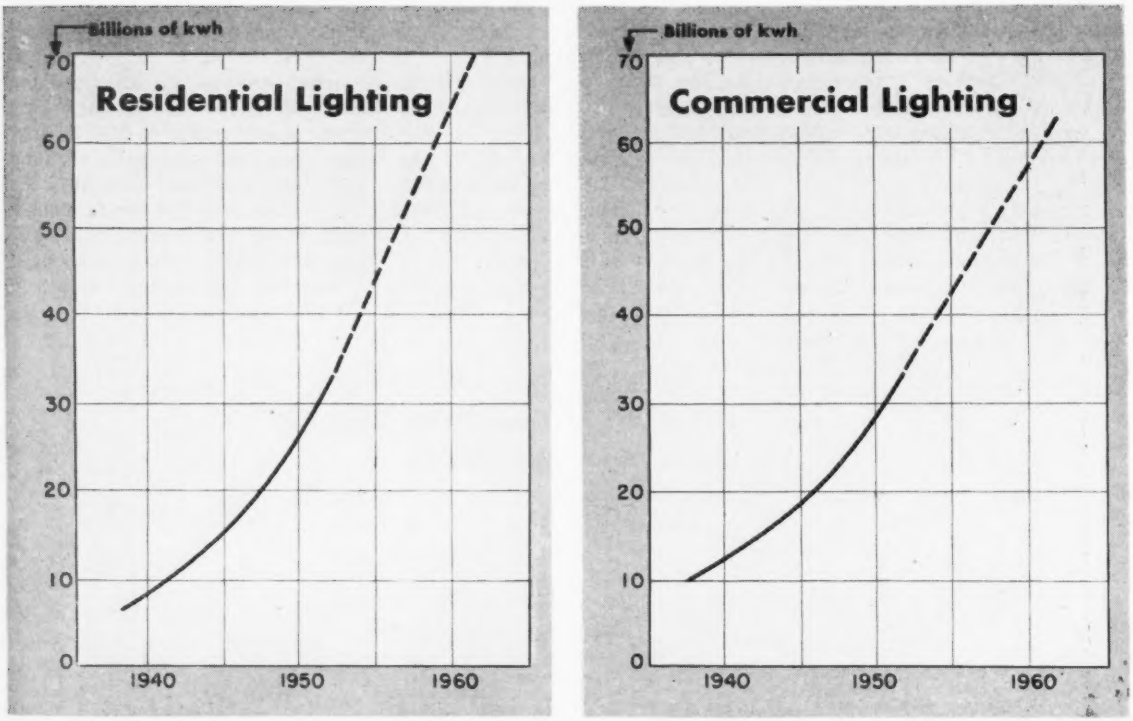
When you consider that the 99.9 billion kwhr consumed by large incandescent and fluorescent lamps in 1952 represented more electricity than public utilitities sold for all purposes in 1938, it's easy to understand why the lighting business has been called the industry's "Topsy."

The big jump from 1938 to 1951 was largely due to the higher footcandle levels that fluorescent lamps made practical for the first time. In 1938, the kwhr consumed for lighting were an estimated 22.8% of all consumption in this country. By 1951, that proportion had edged up to 25.1%; not much of a jump on the face of it, but the difference, or 2.3% when applied to the total kwhr consumed in 1951 represents 8.6 billion kwhr, and that is equal to all lighting use at the end of World War I.

I feel sure you will agree that the story shown on the accompanying charts is a phenomenal one. Briefly, they show that commercial lighting kwhr have more than doubled in the last decade and will nearly double again in the next decade; that industrial lighting kwhr, which experienced a post-war slump, also will nearly double in the next decade; and that


Kwhr Per Year from Lighting in the United States
186 Billion in 1962
Billions of kilowatt-hours
120
116
112
108
104
100
96
92
88
84
80
76
72
68
64
60
56
52
48
44
40
36
32
28
24
20
16
12
8
4
0
1890 95 1900 05 10 14 18 22 26 30 34 38 42 46 50 54 58 62
Landmarks in Electric Lighting
1952 Electric utilities have 48,500,000 customers
1950 Home light conditioning – "recipes" – is announced
1950 Korean War starts
1948 Electric utilities have 41,000,000 customers
1947 "Planned Lighting" program begins
1945 Second World War ends
1945 Circle line and slimline fluorescent
1941 United States enters second World War
1940 Electric utilities have 30,000,000 customers
1938 Fluorescent lamp introduced commercially
1937 Coiled coil filament introduced
1936 Beginning of home advisor activities by utilities
1934 "Better Light – Better Sight" Bureau organized
1934 High pressure mercury lamp introduced commercially
1930 First commercial application of variable colored lighting
1929 Electric utilities have 24,000,000 customers
1925 Inside frosted lamp introduced
1923 First utility lighting service departments
1921 Kitchen lighting campaigns
1920 Electric utilities have 11,000,000 customers
1919 Tipless bulb introduced
1917 United States enters first World War
1913 Gas-filled lamp – 14 lumens per watt
1911 Drawn tungsten filament – 10 lumens per watt
1910 Electric utilities have 2,500,000 customers
1907 Pressed tungsten filament – 8 lumens per watt
1906 Illuminating Engineering Society is organized
1906 Tantalum lamp – 5 lumens per watt
1905 Electric utilities have 1,000,000 customers
1905 Gem lamp – metallized filament – 4 lumens per watt
1903 First large (5,000 Kw) steam turbine installed in central station
1901 Cooper-Hewitt mercury lamp
1900 Intensive development work on steam turbine
1890 White House gets electric light
1882 First electric central station
1881 First commercial incandescent lamp – 1.4 lumens per watt
1879 Edison's first successful incandescent lamp

ELECTRICITY USED for lighting will reach 186 billion kwhr in 1962



ANNUAL CONSUMPTIONS of electricity for lighting by residential and commercial customers follow smooth curves of growth and will amount to 70 billion and 62 billion kwhr respectively in 1962. The curves indicate the stability of the lighting load

residential lighting kwhr, which have tripled in last decade, will likewise double by 1962. Together, they indicate that by 1962 the lighting load will equal the entire utility load of the war-swollen 1943 economy when energy consumption was 186 billion kwhr.

All of us will remember that for a period of seven years beginning in 1938 the entire research, application and marketing forces of the lighting industry were concentrated on our defense plants—and justly so. As a result of this great concentration, we have seen industrial lighting standards rise to unprecedented heights.

But Residential Lighting . . .

Immediately following World War II, the great majority of us put our resources toward the job of supplying the pent-up demands in the commercial field. Thousands upon thousands of stores, offices, and other commercial business places had not been remodeled in ten or more years, and there were many new lighting techniques that had been developed in the interim. The "Broadways" of every city in America shine with the job that was done.

Residential lighting has been the fastest growing of the three markets, virtually without any unified assistance. Nevertheless, one of our recent surveys revealed that at the present rate of improvement it would take residential lighting 99 years to reach today's standards in many stores and offices.

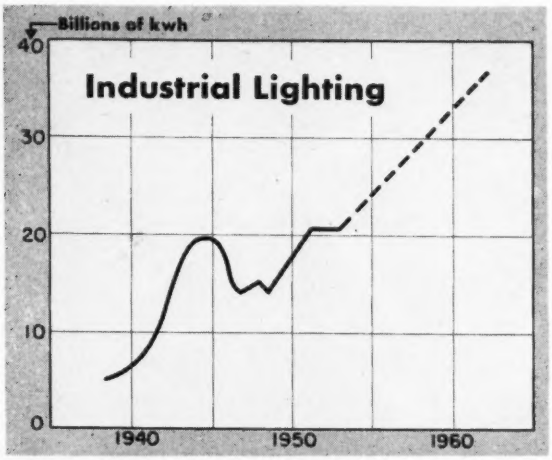
Here is a market rich in potential for the entire industry. The electric utility, the portable lamp and fixture manufacturers, the contractor, builder, wholesaler, retailer—all have a tremendous stake in this untapped mine.

To get a more accurate appraisal of the residential market, we had a well-known independent survey organization conduct the studies I mentioned earlier. Its findings confirmed some rather definite opinions we had about the importance of the home lighting load but which until now were unverified. The survey, covering the 12 months ended last July, indicated that lighting actually is more than 40% of the total residential load.

Before we further explore the potentialities of the residential market, I think it is important to mention a vast undeveloped market combining many industrial and residential charactertistics. This group is rural America, where there are still millions of users not being reached by an organized selling program. The roughly 600,000 unlighted American farms represent a minimum potential of 500 million kwhr annually in new lighting alone. Obviously, relighting the more than 5 million electrified farms is an even greater potential. Existing farm lighting is admittedly below present-day standards and is becoming even less adequate in the light of the new minimums established by the IES.

Can Afford Better Lighting

Now let us return to our discussion of the residential lighting market. I believe every aggressive market man in the lighting industry will buy our premise that the great majority of homemakers want and can afford good home lighting. Added to that there must be a firm realization that through a unified effort every segment of the industry can realize new millions of dollars of sales by bringing the lighting up to the other living standards of the American home. **We must turn customer acceptance into customer demand. How? By increased production of desirable equipment . . . better distribution . . . exciting displays . . . demonstrations . . . sound merchandising . . . aggressive advertising . . . and all of the other**



BEING CLOSELY RESPONSIVE to economic conditions, industrial lighting is not easily amenable to future projection but is estimated to reach 36 billion kwhr in 1962

ingredients that make up a well rounded marketing program.

Lamp manufacturers must continue their research in the field of new light sources aimed specifically at the needs of the householder. We cannot let up for a minute our tests and studies to make existing lamp bulbs and tubes even more efficient and attractive than they are today. All of us must recognize our obligations to continue our education in the field of lighting applications to the user and seller alike.

Trade Allies Can Do Much

The portable lamp and fixture manufacturers can be the strongest allies in the industry. Without them countless millions of dollars spent in light sources development and lighting application can be a total waste. We hope they will continue to use industry's laboratories in developing merchandise that best utilizes today's lamps and bulbs.

The electrical contractor has been the target for countless educational programs and it is gratifying to see that the seeds were not cast on barren rocks. The efforts of NECA and many other independent groups are helping to bring about close coordination among architects, builders, and homeowners with better and more practical lighting the results.

The builder has been one of the bright "lights" in the residential lighting field. Individually, collectively, and with the assistance of local utility companies, many builders have taken light conditioning out of the book and put it into the home. They have found today's concept of residential lighting the first really new thing they have had to talk about and display in the last decade, and they are making the most of it. Light conditioned homes stand out like beacons in new developments, and the records show they are always the first to be sold. If the builder will continue his enthusiasm and answer the demand of the public, all of us are on a new highway to residential lighting sales.

The architect is the one greatest single influence in the residential building field, and much depends upon him. Our Lighting Institute and the resources of other manufacturers are always at his disposal. We hope that he will incorporate and specify built-in lighting with the same wisdom, knowledge, and care he does the plumbing and heating systems. It is in this stage that the home owner gets the best permanent lighting at the best cost.

The wholesaler exerts a tremendous influence in the sale of residential fixtures. We are all aware that fixture allotments are usually too little to meet even minimum lighting recommendations. With intelligent display and salesmanship of well-designed and properly priced merchandise, the lighting dollar can be stretched to its best advantage, and a desire can be created for more and better lighting at a later date.

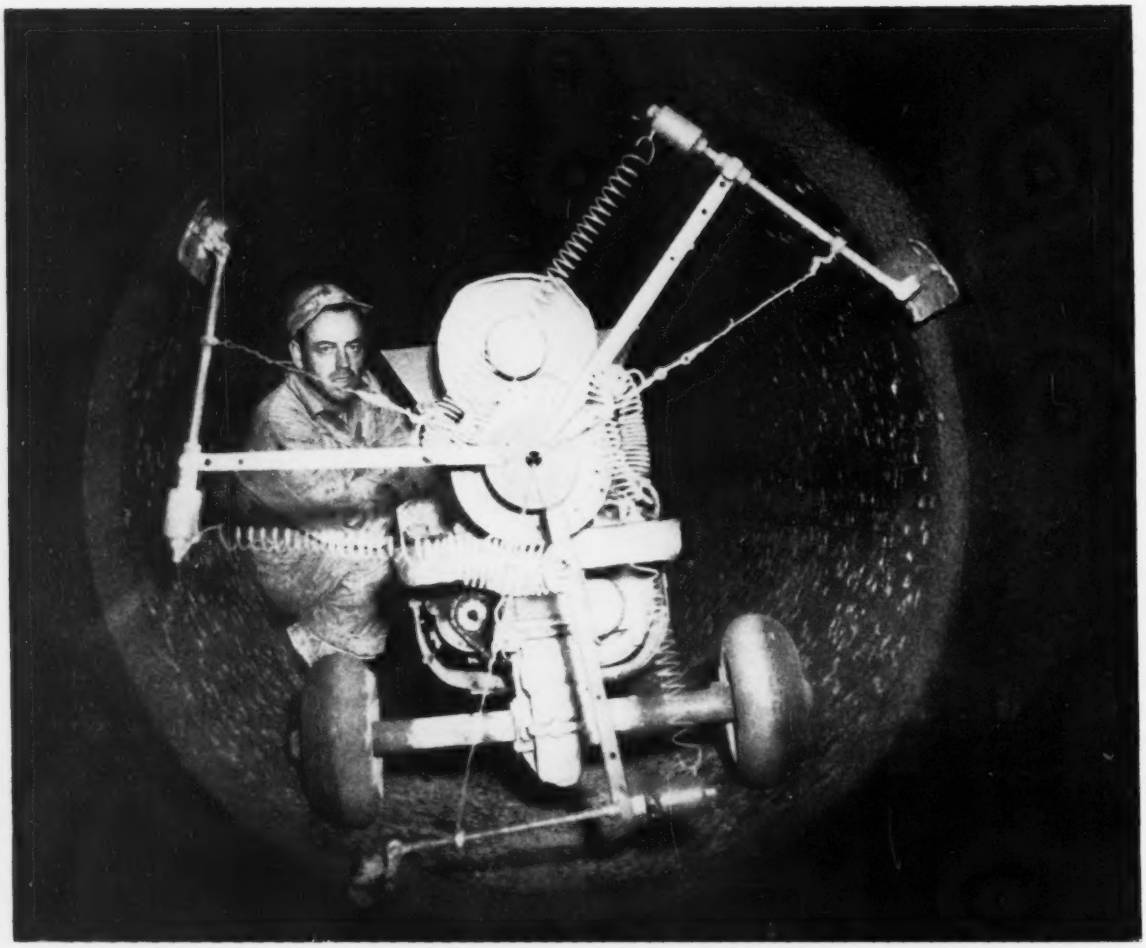
The retail outlet, whether it be a furniture, appliance, or department store, is the "last port of call" particularly in the portable lamp market. It is here that all our work with the consumer, decorator, designer, and portable lamp manufacturer must come into focus. We must encourage this part of the industry to stock good designs and meet their customers' demands with merchandise that fulfills lighting standards, regardless of the period or style. The appliance dealer should be made to realize the profit possibilities of taking a more active part in the lighting picture. Many of them have made a start by exhibiting limited workable stocks of fixtures for the kitchen, laundry, utility room, and bathroom.

The electric utility will, we hope, put new enthusiasm and vigor in its approach to the residential lighting market. It can plan and operate demonstration homes individually and in cooperation with local home builders. Home light conditioning can be demonstrated to club, church, and civic groups. Existing home owners and buyers of new homes look to their local utility for lighting guidance. It is natural that most electric utilities are now doing some of the things that we see as basic necessities. But more significant is the fact that already some utilities are doing everything that we can think of—and more. From this type of effort can come only one result—success.

Not a Free Ride Though

As I look at the next ten years and at our projected 186 billion kwhr lighting load, I remind myself that this is not a promise but a challenge . . . that it rests on not just normal growth with a free ride for all hands, but on the premise of a real selling job . . . that the estimated 1,350 kwhr for lighting per home won't arrive of its own accord by 1962 . . . and that all lighting promotion is futile until we give every consumer an easy place to buy the goods to fill his stepped-up lighting wants.

What are we going to do about it? The answers to this must be carefully considered for the possibilities are innumerable. Does it mean an industrywide lighting promotion program, closer coordination with electrical contractors and other key groups allied to builders, a greater effort to glamorize our product, to lift our product above its utilitarian character? Very likely it means all of this plus a multiplied effort of our present activities. Whatever the answers, it's up to our industry to take a better look at the opportunities in relighting America than we have done in the past 20 years.



PIPELINE LINING MACHINE applies cement mortar to penstock of California Electric Power Co to rehabilitate steel pipe at low cost and provide better hydraulic efficiency. Mortar is thrown on centrifugally and smoothed in place by revolving trowels. Rivet heads are covered

Mortar Lining Extends Penstock Life and Restores Original Capacity . . .

. . . of four pipelines on California Electric Power Co's hydroelectric system. Badly corroded steel flow lines were reconditioned at a cost much less than replacement

PAUL H. YELTON, Construction Engineer, California Electric Power Co, Riverside, Calif.

Cement mortar linings placed by a special method in existing pipelines have improved hydraulic characteristics, stopped corrosion, and strengthened weakened sections of steel pipe in California Electric Power Co's hydroelectric system. To date the company has used the process to line 1,495 ft of 48-in., 3,300 ft of 34-in., and 7,750 ft of 24-in. flow line; and 4,360 ft of 54-in. riveted steel penstock. The ⅜-in. lining covers rivet heads. Although the process has been used for years by water utilities, these are the first applications on a hydroelectric project.

Better Operating Efficiency . . . Restoration of penstock flow coefficient to its original value in one small plant increased operating efficiency and plant capacity enough to pay for the lining job in a few years. Application to the penstock followed discovery of serious tuberculation which was reducing plant output. The pipe had not deteriorated enough to require immediate replacement, although without protection it would not have lasted many more years. After the penstock was cleaned, the ⅞-in. pipe wall was found eaten through in spots as a result of tuberculation.

Replacement cost under present conditions would have been several times the cost of reconditioning. New pipe, coal-tar enamelled inside, would have cost approximately $27 per ft installed, compared to a contract price of $3.92 per ft for cement mortar lining. This latter price includes cutting and welding all necessary openings in the pipe.

Favorable reports on prevention of corrosion and improvement of flow coefficient had been received from a dozen water utilities which had used the lining process. Only one report indicated any danger that the lining might break off and go down the pipe. In this case the lining had been placed by a process different from the one under consideration. Although the mountain stream water in the company's area is slightly acid during the spring run-off, it is nearly neutral most of the year. It is felt that there is little danger of this water dissolving the lining or reacting chemically with it.

Cleaning the Pipe . . . One advantage of cement mortar over coal tar enamel lining is that it can be applied to a surface not so thoroughly cleaned. It is difficult to clean an asphalt-emulsion-painted surface sufficiently for an application of coal tar enamel, although several of the company's penstocks have been successfully treated with this material. No matter how badly tuberculated the surface may be, there is always a large proportion of asphalt remaining that is "live" enough to be difficult to remove. Coal tar enamel is applied at 485 F, and the smallest particle of asphalt remaining will boil through and prevent a bond.

In the application of cement mortar lining, the loose material from corrosion and old coatings is removed first. Cement mortar can be placed over any remaining paint or enamel as long as these materials in turn adhere tightly to the pipe surface.

To clean the penstock a hydraulically operated cleaning tool was forced through the pipe by filling the penstock and controlling the water flow with a valve at the lower end. Steel scrapers and wire brushes around the periphery of the tool removed the tuberculation. Two passes of the tool removed loose material. Hand cleaning had to be done around the rivets where the machine couldn't reach.

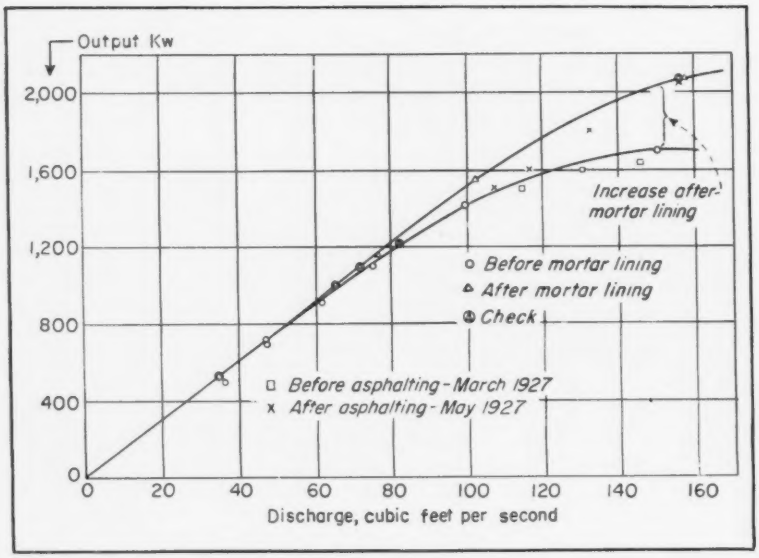
POWER AND MORTAR for lining machine are supplied from van which moves along pipe as job progresses. Electric cables carry power to lining machine and electric hopper in pipe. Mortar is mixed in van and is transferred through "elephant trunk" into hopper

Applying the Lining . . . Consistency of the lining when applied is similar to that of a stiff mortar for brick laying. Proportions are five sacks of sand, four of Portland cement, and one of pozzolanic cement to improve workability and delay setting time. Aggregate is clean, well-graded silica sand to pass a number 16 mesh screen.

Mortar mixer and engine-driven generator are in a van which moves along the line as work progresses. Insertion and removal of the lining machine require openings in the pipe at each end. In this case a 56-in. length of half of the penstock was removed near the lower end, and the top half of the adjacent wood-stave pipe was removed at the upper end. Access openings 20 in. in diameter at about 700-ft intervals permit transfer of mortar from the van into an electrically driven buggy in the pipe, which transports the mix to the electric lining machine.

Mortar is placed on the pipe wall by the special compact electrically-driven machine. A worm feed forces mortar from the hopper into a rapidly revolving dispensing head. This head throws the mix off at a high speed, distributing it at a thickness determined by rate of travel. For a lining ⅜-in. thick rate of travel is about 2 fpm. Slower revolving arms attached to a separate part of the head carry trowels which follow directly behind the spread mortar and produce a lining with a smooth finish and even thickness.

The machine can line satisfactorily around long radius bends. But for short pipe angles the distribution of mortar is uneven, and the trowels will not work. These sharp bends, special fittings, and outlets must be lined by hand.



INCREASED OUTPUT of Bishop Creek Plant No. 6 for a given discharge results from elimination of tuberculation by lining penstock with cement mortar. Results of earlier asphalt emulsion lining show need for more permanent lining to maintain hydraulic efficiency

After the lining is placed, all openings are closed as tightly as possible to retain moisture for curing. The following day any necessary hand-patching is completed. The second day after the application the pipe can be filled. After the water stands for 24 hours, the penstock can be placed in service. In this penstock it was necessary to complete the entire lining before the pipe could be filled. A few shrinkage cracks developed, but experience shows that they close up as soon as the pipe is filled with water.

To prevent too rapid curing of the lining, sections of pipe which are exposed to direct sunlight should be cooled by water spray during the placing and for 48-72 hours thereafter. Time required for application of a lining is relatively short. This 4,360-ft length of penstock was lined in eight working days. Setting up, running, and removing the cleaning tool required five additional days.

Smooth surface of the lining covers the rivets completely so the resulting flow coefficient based on the slightly decreased inside diameter is and should remain practically as good as new pipe. Tests made before and after this application indicate Williams-Hazen flow coefficients of 85 and 135, the latter based on the new inside diameter.

Annual gain in plant output resulting from lining the penstock will approach 1 million kwhr, which will pay for the treatment in about four years. The corresponding increase in plant capacity is also of value at times of system peak load.

Sound 15 Months Later . . . Inspection of the line in February 1952, 15 months after placement, showed the lining to be sound and apparently giving complete protection against corrosion. At one location where tapping seemed to give audible indication of some separation, a sharp hand pick was used to break out a section of lining about 1½ in. in diameter. No rust was visible on the metal, and the cement mortar appeared to be well-bonded to the pipe. So much effort was required to remove the small portion that it seemed there was little likelihood of sections breaking off and going down the pipe.

It was possible to scrape off a small amount of the surface of the lining with a fingernail, but the mortar underneath was very hard. Sand apparent on the bottom third of the pipe seemed to indicate that the rebound sand from placing the lining was still in place on the surface of the mortar. Had any appreciable dissolving of the lining taken place, this rebound sand would have been washed away. Trowel marks and small chunks of mortar which had fallen were rounded somewhat, but many of the edges were still fairly sharp indicating that there was little action of the water on the mortar. Even where it had been necessary to make a hole in the lining from the outside after it had been placed, the lining appeared to be in good condition around the hole.

Other Applications . . . California Electric has made three other applications of the process. In one case it was used on a badly corroded piece of pipe made of $\frac{3}{16}$-in. plate in a tunnel under a dam. The lining was applied to preserve the pipe, which had not been reconditioned since its installation in 1916, and to increase flow coefficient.

In the second case a flow line was too far gone to treat by any other method. Cleaning and lining was done for $2.90 per ft, saving a replacement job which might have run over $20 per ft. Replacement also would have taken the line out of service for a longer period.

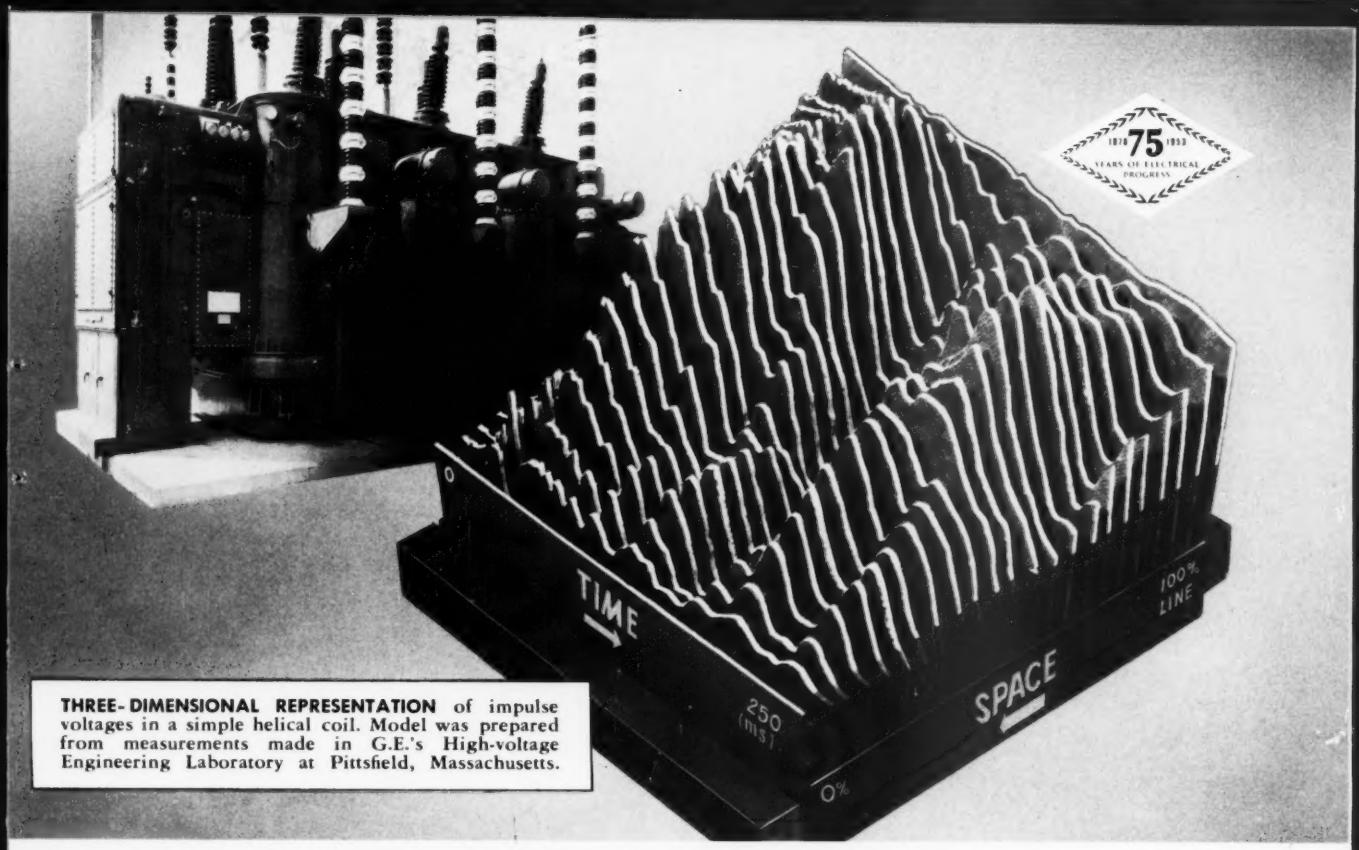
Results of the first three applications were so successful that in September, 1951, a ⅜-in. cement mortar lining was placed in 7,750 ft of the Birch Creek flow line. This 24-in. ID, steel line had deteriorated to the point where serious leaks were developing frequently.

The pipe was located in rough terrain which precluded the use of the contractor's van. Portable units were substituted, and a very satisfactory job was accomplished. It was thought that this pipe was so far gone that complete replacement would be required; but after inspecting the completed mortar lining, it is felt that this flow line is now good for many more years of service.

Operating Experience . . . In all four applications a very dense lining resulted. Compression tests of samples taken on the jobs showed breaking strengths of about 6,000 to 7,000 psi. All four jobs are very satisfactory from the standpoint of installation and immediate benefits and are expected to give good service for a long time.

The 48-in. and 34-in. flow lines were drained and inspected after eight months of service. Some cracks and imperfections were found, possibly because of curing conditions and irregularities in the pipe, but none of them appeared to be serious at that time. The fine condition of long stretches of lining indicate that the mortar can be applied and cured so as to be practically perfect.

Contract work on the patented process was done by the Centriline Division of the American Pipe & Construction Co, Los Angeles.



THREE-DIMENSIONAL REPRESENTATION of impulse voltages in a simple helical coil. Model was prepared from measurements made in G.E.'s High-voltage Engineering Laboratory at Pittsfield, Massachusetts.

Major G-E development promises new high in reliability of super power transformers

NEW METHOD, PERFECTED OVER THREE-YEAR PERIOD, SIMPLIFIES ANALYSIS OF TRANSIENT VOLTAGES

In high-voltage transformer windings, insulation is a costly necessity. It complicates thermal and electrical characteristics and requires the use of additional copper and iron, thus adding to a transformer's over-all size and weight. Most efficient use of insulation is obtained when the designer has complete knowledge of the transient voltages which can occur under impulse conditions.

General Electric engineers were the first to prove the existence of dangerous transients in all transformers under impulse. They pioneered methods for calculating them, developed shielding to protect against them, and introduced commercial impulse testing as the user's assurance of reliability.

With the growing demand for transformers having higher and higher voltage and kva ratings, a more rapid means of determining transient voltages would speed up the manufacture of these large units and increase their reliability. For many years, engineers the world over have been working to obtain such a method.

Transient-voltage phenomena are very complicated as illustrated above. In modern power transformers, these voltages are even more complicated due to a wide variety of winding structures and arrangements, taps and ducts.

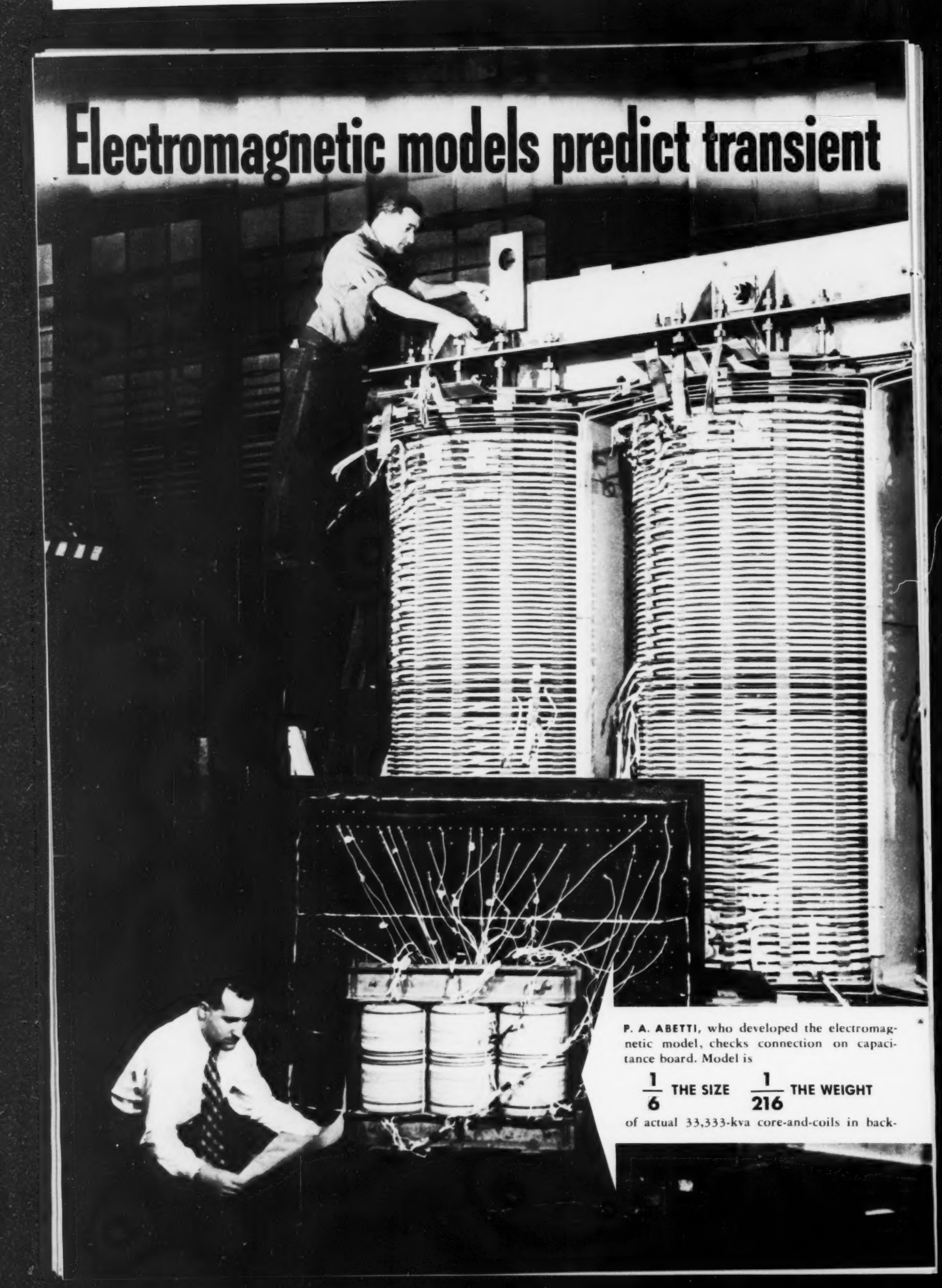
Purely mathematical computation of transients has yielded good results on a single uniform coil, but is extremely laborious and impractical for larger, more complicated transformers. Three years ago, G-E research and development engineers launched a program to find a practical means of furnishing, in the design stage, the transient voltage magnitudes and wave shapes at as many points in the winding as required by the designer.

G-E studies considered both geometrical models, which cannot reproduce the transient response of the original transformer, and equivalent-circuit models whose mutual inductances, capacitances and other characteristics cannot be computed accurately in a reasonable time. Neither method was found to be practical. Finally, in a major contribution to the transformer art, General Electric engineers combined the best features of both types in the *electromagnetic model.*

For further details, see next page→

GENERAL ELECTRIC

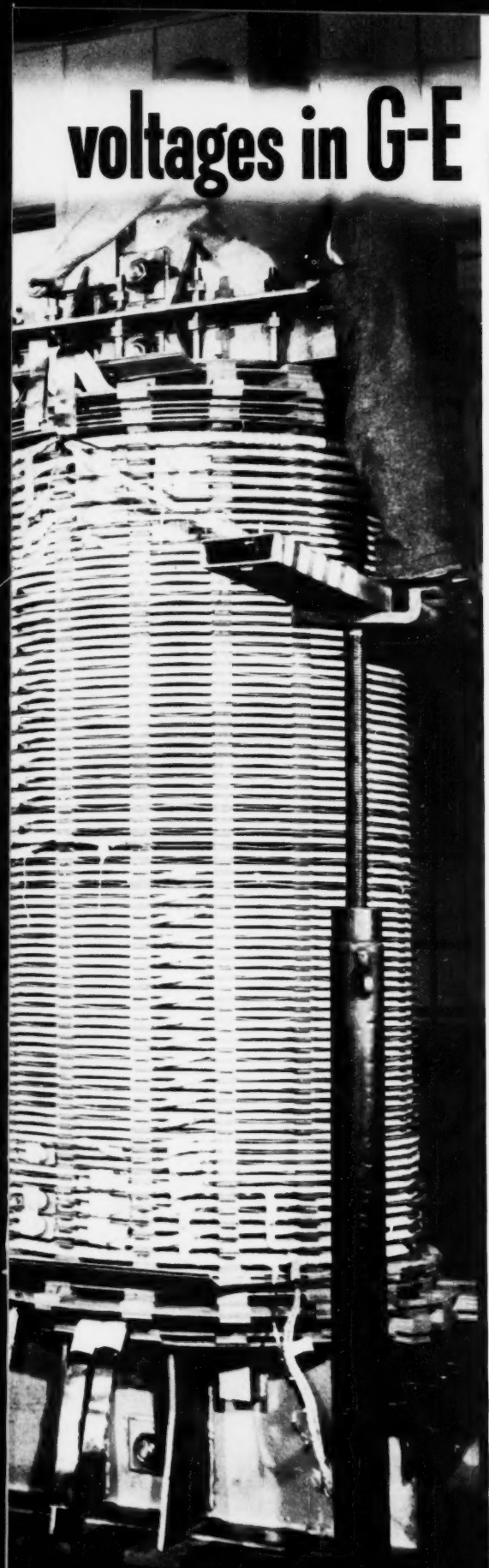
Electromagnetic models predict transient



P. A. ABETTI, who developed the electromagnetic model, checks connection on capacitance board. Model is

1/6 THE SIZE 1/216 THE WEIGHT

of actual 33,333-kva core-and-coils in back-



voltages in G-E power transformers . . .

before they are built!

With the *electromagnetic model*, General Electric engineers can quickly obtain complete and accurate knowledge of transient voltages in any power transformer . . . in the design stage.

Voltage magnitudes and wave shapes can be determined for all points of interest, for all types of applied waves, and for all winding connections. The following maximum transient voltages are typical of the information now at the G-E designer's finger tips:

1. Voltages from impulsed winding to ground.
2. Voltages across large parts (6 to 50%) of winding.
3. Voltages across small parts (1 to 5%) of winding.
4. Voltages to ground transferred to non-impulsed windings.

The first electromagnetic model was a model of a single-phase transformer rated 667 kva, 13,200 to 2400/4160 Y volts. Since that time, models of progressively higher ratings have been built and tested. Typical is the model shown, of a three-phase transformer rated 33,333 kva, 115,000 to 37,090 Grd. Y to 4,160 volts. This model was designed and built in advance of the actual transformer shown with it. It has 156 points available for test.

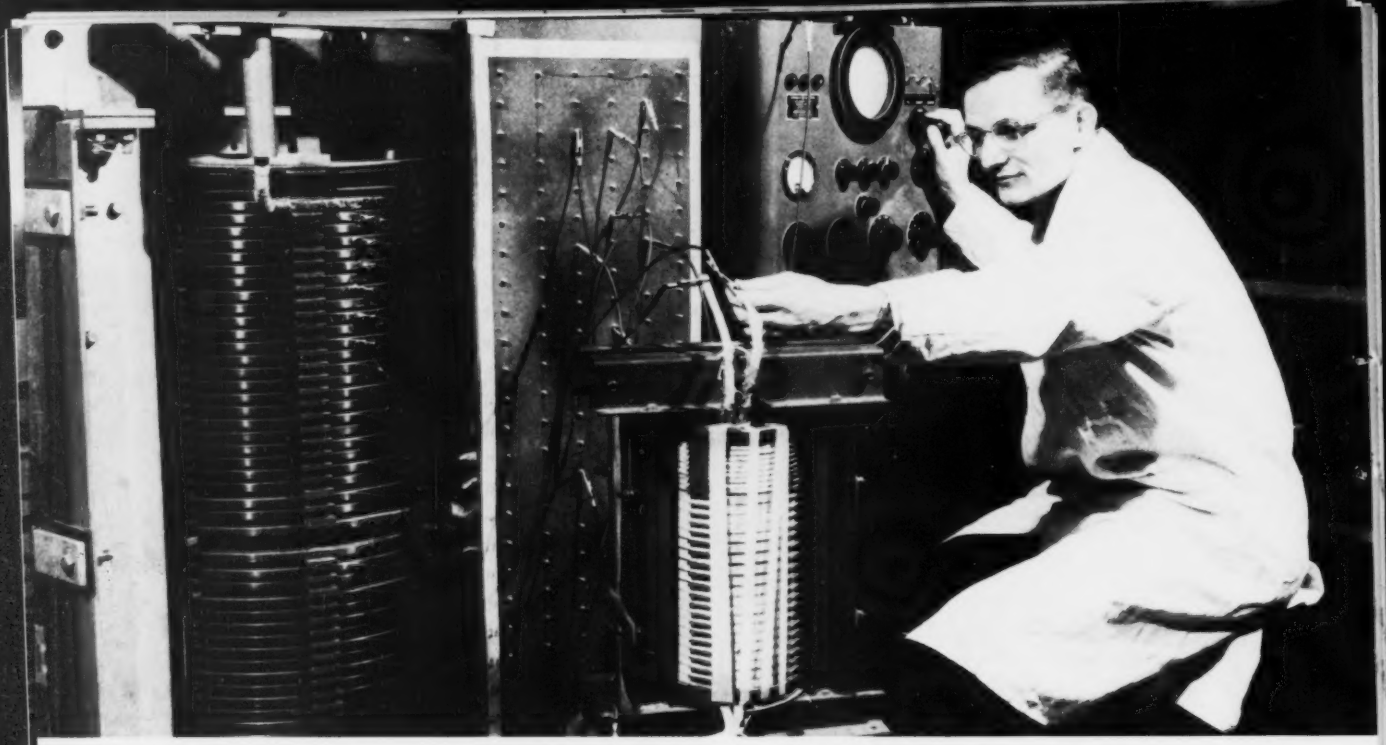
Among the many models that have been built to date is that of a proposed three-phase 250,000-kva transformer, 138,000 to 15,000 volts. The model has one-tenth the length and one-thousandth the weight of the full-size transformer. Four different winding arrangements were tried to determine the most effective structure for this transformer. A model will soon be built of the 300,000-kva, 161-kv transformers now on order.

Electromagnetic models are now being used to improve present transformer designs and to determine transient voltages in new winding structures. In special cases, models are being built to determine which winding structure is best suited to meet a particular transformer's requirements. They are also used to determine the performance of a transformer as a component of the power system.

The new knowledge of transient voltages gained with this development is already reflected in design improvements which are bringing a new high to the reliability of your G-E power transformers.

Progress in Power Transformers

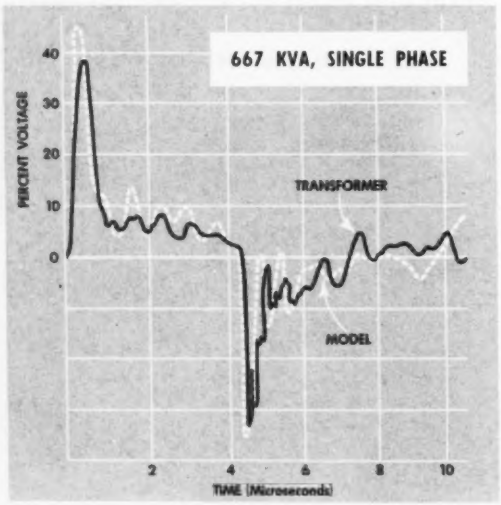
GENERAL ELECTRIC



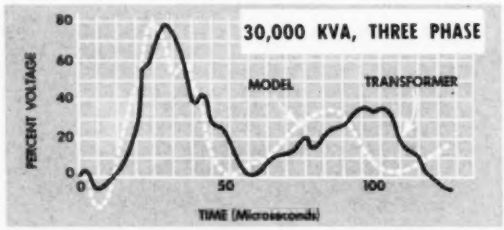
Test results check accuracy of "electromagnetic models" against performance of actual core-and-coils

On eleven models built and tested in 1950 and 1951, 238 measurements of the maximum voltages between corresponding points on the models and on the actual transformers showed an average deviation equal to only 4.3 percent of the applied wave and 9.8 percent of the voltage appearing in the transformer . . . an accuracy more than adequate for design purposes. The tracings of typical oscillograms shown below were obtained between corresponding points of two transformers and their models. They show how closely the model predicts the electrical performance of the actual core-and-coils.

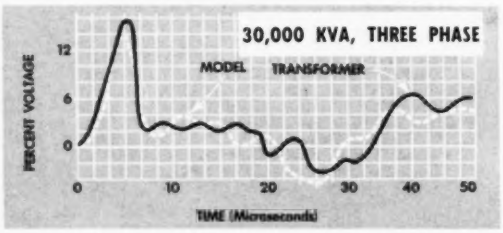
For more information on electromagnetic models, write to Section 421-2, General Electric Company, Schenectady 5, New York.



Chopped-wave impulse voltages across first duct from line end of high-voltage winding.



Full-wave impulse voltages to ground at 36% high-voltage winding from neutral.

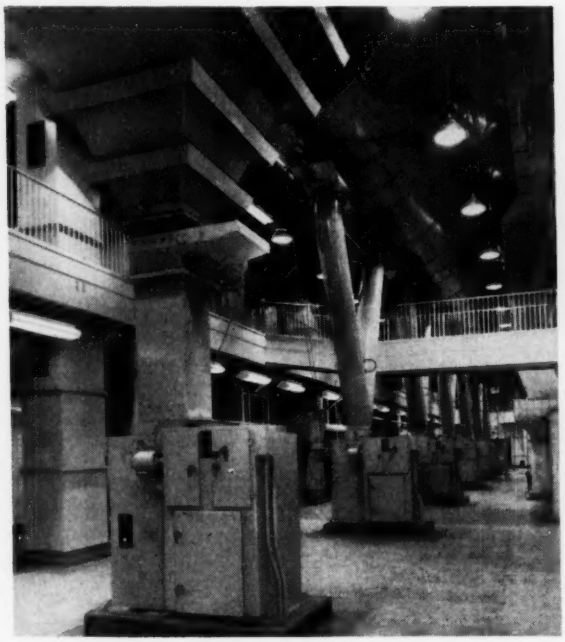


Full-wave impulse voltages across thirteenth duct from line end of high-voltage winding.

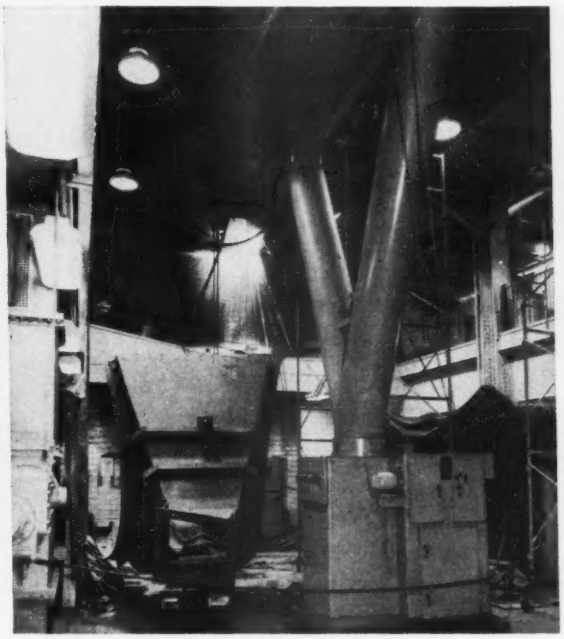
You can put your confidence in—

GENERAL ELECTRIC

LITHO'D IN U.S.A.



OLD STYLE bunkers, in rear, with dead spots, were rebuilt with a steep slope bottom (foreground) to facilitate feeding of coal



HOPPERS were built in a local contractor's shop and moved to the job ready for connection to the bunker. They were sloped to fit

Rebuilt Bunkers Eliminate Hot Spots And Explosions Caused by Dead Coal With High Sulphur Content

J. D. WILLIAMSON, Assistant Manager of Power Production, Dayton Power and Light Co, Dayton, Ohio

Problems of spontaneous combustion and hot spots in the coal bunkers prompted a redesign and rebuilding of bunkers at Dayton Power and Light Company's O. H. Hutchins station. Suspended steel bunkers of 1,200-tons capacity, 600 tons per boiler unit, were installed when the station was built in 1948. They were of a design similar to the bunkers which had given satisfactory service at the Frank M. Tait station since 1937.

However, a change in coal supply caused difficulty with coal flow. Holes formed and extra labor was required to keep coal moving. There were dead spots where none moved at all.

Bunkers were sealed, with terrazzo floor forming the roof. Negative pressure was maintained in the bunkers with an exhaust fan discharging to the roof.

High sulphur content coal lying in a dead spot overheated and gave off methane gas causing an explosion. This prompted studies of possible measures to prevent a recurrence. The result was a redesign of bunkers to provide a steep sloping bottom and eliminate "dead" spots where coal might collect.

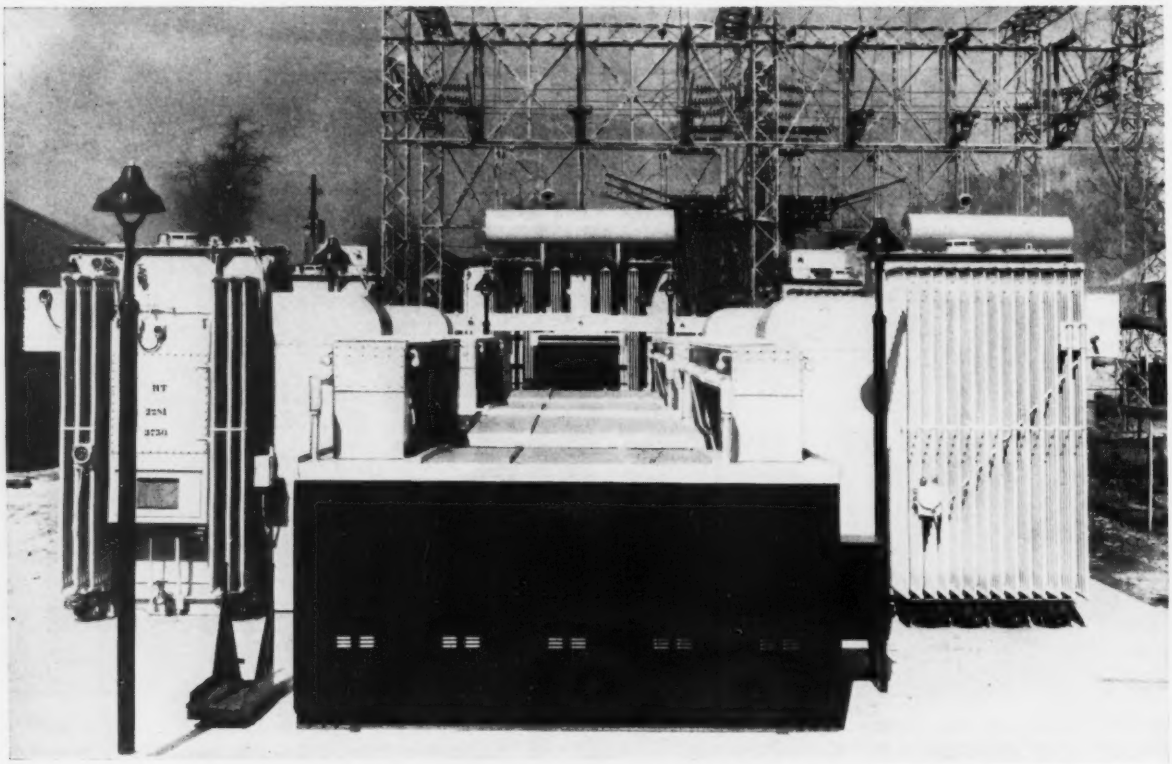
Straight-side hoppers of maximum size consistent with maintaining the necessary structural strength of the bunker were designed. Since each coal scale was fed from two pipes from the bunker which joined into a single pipe just above the scale, it was necessary to install two hoppers over each scale. Since the outlet of each hopper was much lower than the former bottom of the bunker, it meant a considerable shortening of the pipe feeding the scale.

The hoppers were built in a local contractor's shop and moved to the job ready for connection to the bunker. They were shaped to fit the contour of the bunker after the part of the bunker enclosed by the hopper had been cut away.

The hopper was first riveted to the bunker and then seal welded.

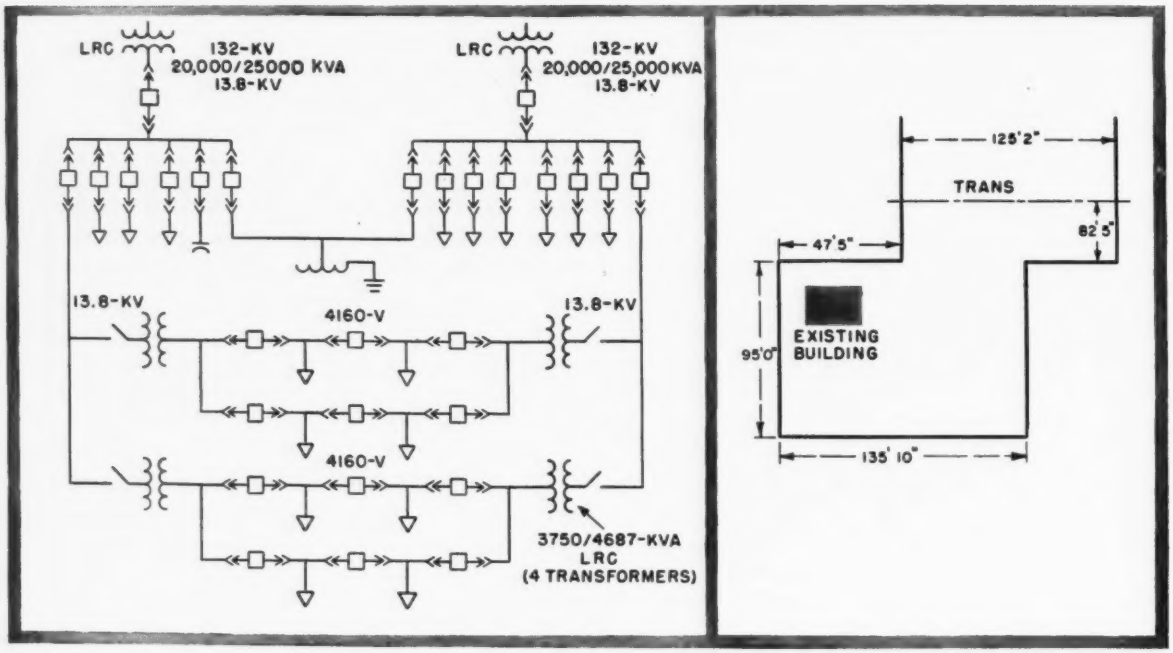
These hoppers have not been in service long enough to pass final judgment on them. However, on one test of ¼-in. by 0 dry coal, the bunker emptied without assistance. Tests will be run on similar coal when wet. If wet coal hangs up, plates with Syntron vibrators will be installed in appropriate locations.

There are still flat spots in the bottom of the bunker between hoppers where the coal can not move. To guard against overheating these might be filled with an inert material such as sand. Actually, the bunkers will be filled with two inch N & S low sulphur coal first and then with the ¼ by 0 coal. Thus, the dead spots are filled with a coal that has never given trouble with heating in the past.

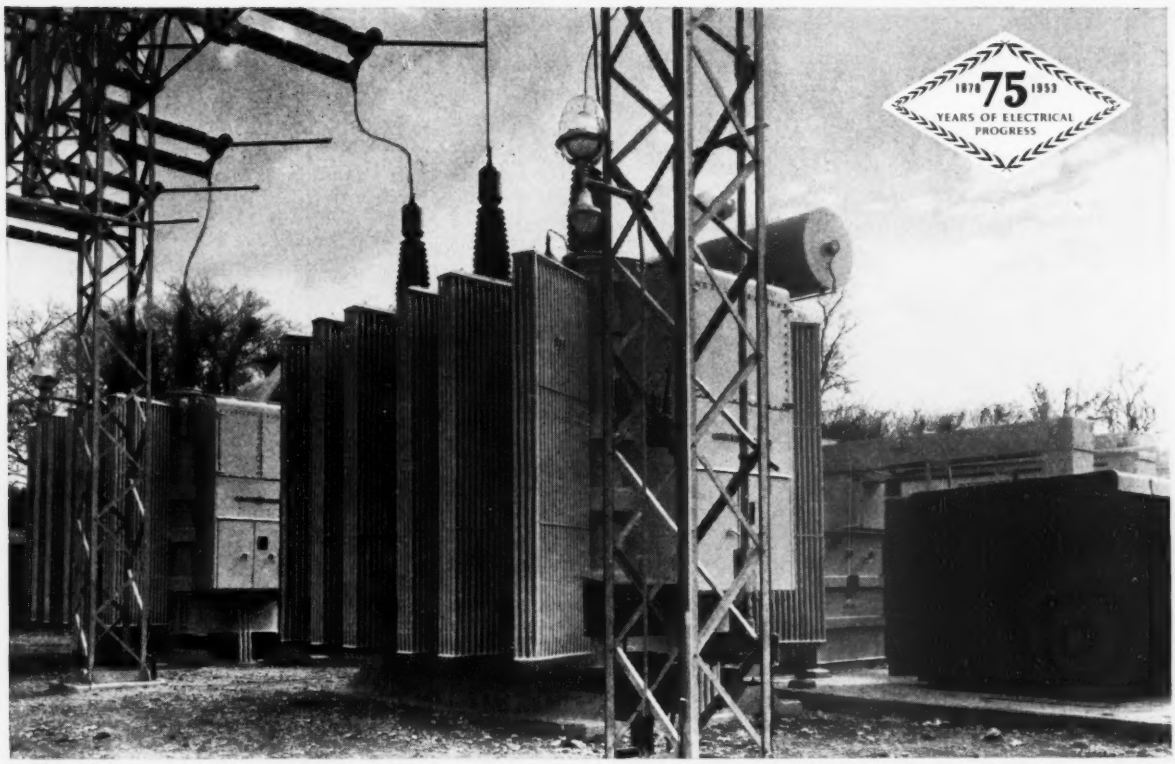


SAN ANTONIO'S 10TH STREET SUBSTATION, one of the largest built by General Electric, is rated at 40,000/50,000 kva, serves its area through nine outgoing 13,800-v feeder circuits in addition to eight 4160-v circuits fed from duplex units.

Utility just draws one-line diagram and



PLANS FOR UTILITY EXPANSION begin with these drawings. A one-line diagram, shown at left, and a simple plot-plan are all that G-E engineers needed to start work on big unit substation for San Antonio. Installation was completed in record time.



LOAD RATIO CONTROL in 25,000-kva transformers provides bus regulation for the 13,800-volt feeders, two of which feed double-duplex units. LRC in duplex units regulates each pair of 4160-v feeders. The substation supplies downtown San Antonio.

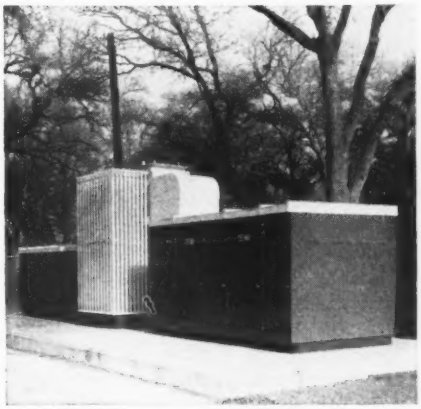
plot-plan to specify 50,000 kva substation

An example of fast, low-cost expansion with G-E unit substations.

The 10th Street substation in San Antonio was planned to feed the city's rapidly expanding system. The utility found it had only to furnish General Electric a simple plot-plan and one-line diagram—similar to those shown at the left—to get the job started fast.

Working from these drawings, General Electric easily and quickly provided a large, double-duplex master unit substation, rated at 40,000/50,000 kva. This standardized equipment answered space requirements as well as the needs of the utility's fast-growing loads.

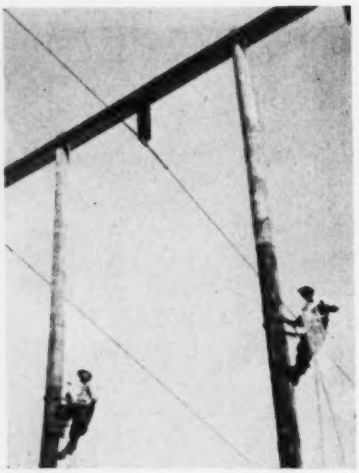
The City Public Service Board's experience with this G-E substation is further evidence of the trend to standardized equipment in utility expansion programs. G-E unit substations, with their great flexibility, find application in a variety of system arrangements. For full information, write for Bulletin GEA-4500. *General Electric Company, Schenectady 5, New York.* 321-101



BRACKENRIDGE SUBSTATION: One of 30 similar substations installed on San Antonio's system. G-E equipment simplifies expansion.

GENERAL ELECTRIC

WOODPECKER HOLES in one of replaced poles. In one 5-mi section of line thru wooded area, 50% of the poles required replacement within a 12-month period



WIRE MESH is installed in 4-ft wide horizontal sections with 2-in. overlap

Steel Mesh Solves Woodpecker Problem

W. L. RUSH, Supt. of Transmission and Distribution, Louisiana Power & Light Co, New Orleans, La.

The installation of steel wire mesh on transmission tower poles in wooded areas has solved a difficult woodpecker problem for Louisiana Power & Light Co.

Previously, woodpeckers started work on the poles, even before the construction crews left the job. In one 5-mi length of transmission line, 50% of the poles required replacement within 12 mo. This is typical of wooded areas. Furthermore, long poles are now very hard to obtain—with 6 mo as the shortest delivery time for 65-ft and longer poles. Many companies are now forced to use fir poles—at 50% increase in cost.

Before the wire mesh was used, various other schemes were tried to discourage the woodpeckers. Old poles which had to be replaced were left standing—but the peckers quickly moved over to the new poles. Apparently the vibration of the energized transmission line held some attraction. Metal snakes, placed on the poles, failed to frighten the peckers.

The wire mesh protective method was started 5 yr ago and has been installed on about 25% of our lines—all in wooded areas. It has been 95% effective in solving the problem. The wire mesh is installed by contractors at an average cost of about $7.50 per pole. This cost figure covers transportation and living expense.

The ½-in. No. 19 gage galvanized wire mesh is furnished by Louisiana Power & Light Co. Five carloads have been installed so far—350 rolls per car. Rolls are 4-ft wide and 100-ft long. Poles are completely covered from the top to 12 ft above the ground. The wire is overlapped 2 in. horizontally and vertically. The wire is installed in horizontal sections. Vertical installation was tried, but the pole taper and wire stiffness made the installation difficult. Pole tops are capped. Wire is notched around arms.

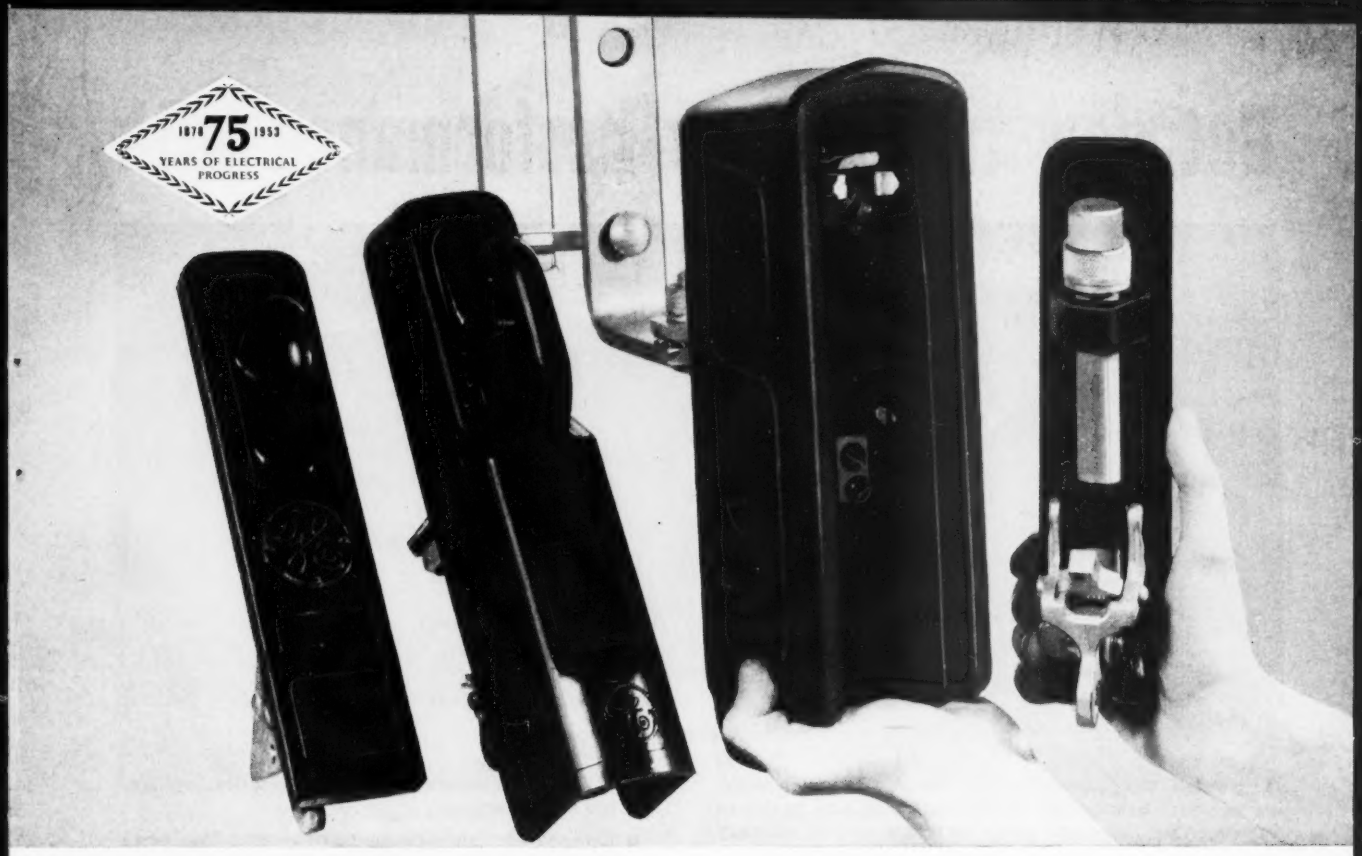
At first, No. 23 gage wire was tried but the peckers were able to penetrate it. Also the wire was first terminated 20 ft above ground, until the 12-ft height was found necessary.

One of the few cases where the woodpeckers have penetrated the wire was where a hole had been covered. It is thought a bird was trapped in the hole. Now, before covering a hole, a separate patch is secured over it.

Auto Tires Make Guy Wire Holders

Old automobile tires converted to guy wire holders increase safety of handling various sizes and kinds of guy wire. Sections of old tires are cut out to aid reeling and unreeling wire. Line crews prefer the tire wire holders to the metal guy wire reels. About 20 are now in constant use and another 25 are planned. H. D. Ownby, Asst. Safety Director, Florida Power Corp, Winter Park, Fla.

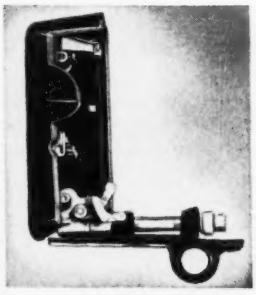
1878 75 1953
YEARS OF ELECTRICAL PROGRESS



Four cutouts in one

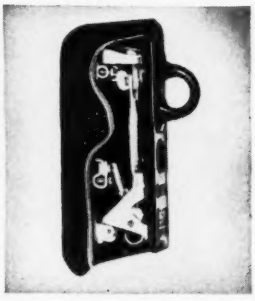
by simply changing doors

Indicating



Drop-out

Reclosing



Disconnect

A G-E FEATURE SINCE 1937! By stocking only three interchangeable doors which fit both 5.2- and 7.8-kv, 50-ampere housings, you get the 4 operating functions illustrated at the left. Available also in 100-ampere ratings, this unique flexibility reduces inventory and simplifies stocks.

INDICATING OR DROPOUT WITH A TWIST OF THE WRIST! A small wire yoke, easily inserted or removed, determines whether the fuseholder door "kicks out" at the bottom for visual indication, or drops open—either way giving positive evidence of a blown fuse.

RECLOSING DOOR AVOIDS UNNECESSARY SERVICE TRIP! The two-element reclosing door restores service within one second after a temporary fault blows the first fuse link. By saving a service trip, the two-shot cutout pays for itself the first time it operates!

FLEXIBLE DISCONNECT BLADE CAN'T GET LOST! It's fastened to the door—can't be misplaced. This disconnect blade doubles the continuous current rating of the cutout. When the blade is disconnected and the door closed, the flexible cable extends downward to indicate that the circuit is open.

WHAT'S MORE THE CUTOUT IS LIBERALLY DESIGNED —has high dielectric strength, uses silver-plated contacts, provides full-range interruption of fault currents, and is conservatively rated. All live parts are completely enclosed for maximum safety.

For complete information contact your G-E Apparatus sales representative, or write for Bulletin GEA-3448. General Electric Company, Schenectady 5, N. Y.

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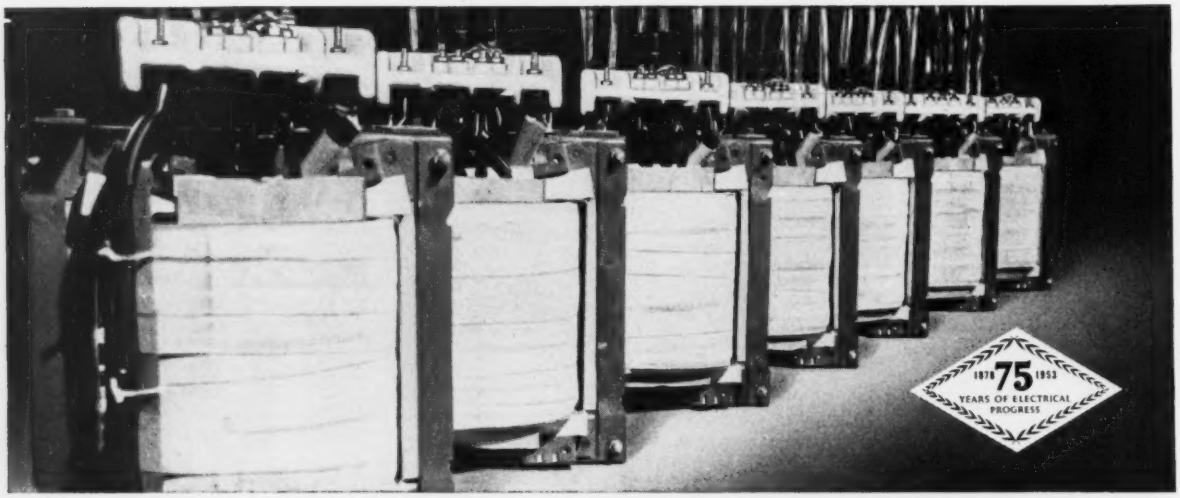
GENERAL ELECTRIC

Get new transformer performance with



G-E Spirakore Universal replacement core-and-coils

Here's the simple, easy way to restore your small burned-out distribution transformers of any make to "active" life for many more years of service. Simply install General Electric universal replacement core-and-coils of the famous Spirakore design (3 to 25 kva).

About ⅔rds the Cost of a New Transformer. By the use of G-E replacement core-and-coils, your old transformers can be restored "good as new" at substantial savings. You can also up-rate your present 1½ and 3-kva transformers to 3 or 5 kva, in some cases 7½ or 10 kva, depending on tank dimensions. In addition, 2400-volt transformers in steel tanks may also be changed to 7200 volts with new core-and-coils and new high-voltage bushings.

Advantage of Modern Design. G-E replacement core-and-coils incorporate all of the design advantages inherent in the latest manufacturing practices, such as:

- High insulation strength, 60-cycles and impulse
- Liberal design, resulting in conservative operating temperatures
- Uniform electrical characteristics with low losses and excellent voltage regulation. Low exciting current
- Modern voltages and taps

Guarantee. G-E replacement core-and-coils carry the same guarantee as new transformers. They are supplied with a nameplate bearing a new serial number for attachment to rebuilt transformers.

Your transformers can be repaired at your nearest G-E Apparatus Service Shop, where trained personnel and special equipment is available for prompt service, or they can be renewed in your own shop.

Call your nearest G-E sales office or G-E Service Shop, or write for additional information on replacement core-and-coils. Address Sec. 431–1, General Electric Company, Schenectady 5, New York.

*Registered trade mark of General Electric Company

Typical G-E Service Shop operations in up-rating a 3-kva transformer to 5 kva

1 Transformer cores are being removed from tanks. All bushings, fittings are also removed. A job number tag is attached to the tank and the small fittings are placed in a metal basket which is tagged with the same job number as the tank to which they belong.

2 Tanks are immersed in an alkaline solution to loosen and break down old paint film and sludge on inside of tank, then cleaned with a high pressure steam machine. Tanks are spray painted with a primer and a final coat of G.E.'s famous Melaglyp finish.

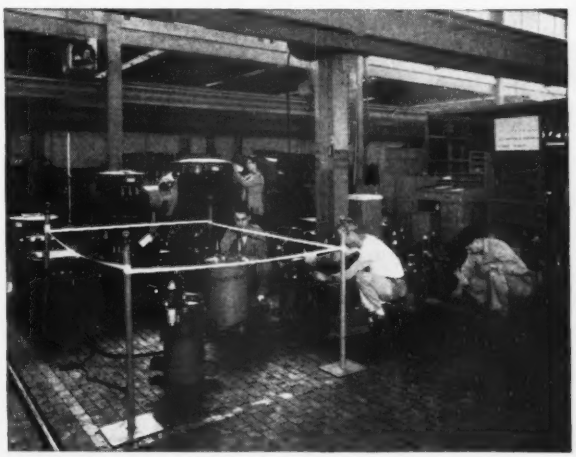
G-E Spirakore* replacement core-and-coils

with the same guarantees as a new transformer *at about 2/3rds the cost*

3 Small fittings are cleaned, inspected and spray painted following same careful procedure as that used for the tanks. Here, the completed and painted parts are assorted by job number, to simplify re-installation on the tanks from which they are removed.

4 The tanks with replacement core-and-coils installed are removed from oven while still hot. The core-and-coil assembly is then covered with new G-E No. 10-C oil immediately. The girl is checking oil content to make sure tanks are properly filled.

5 In this view, the renovated tanks, reclaimed bushings and accessories are matched to each other for final assembly. At this stage the electrical connections are made to the replacement core-and-coils and transformer is ready for inspection and test.



6 The rebuilt transformer is tested according to factory specifications, and given a final physical inspection. These photos taken in the G-E Service Shop in Richmond, Va., show the careful handling your transformers will receive in any G-E Shop.

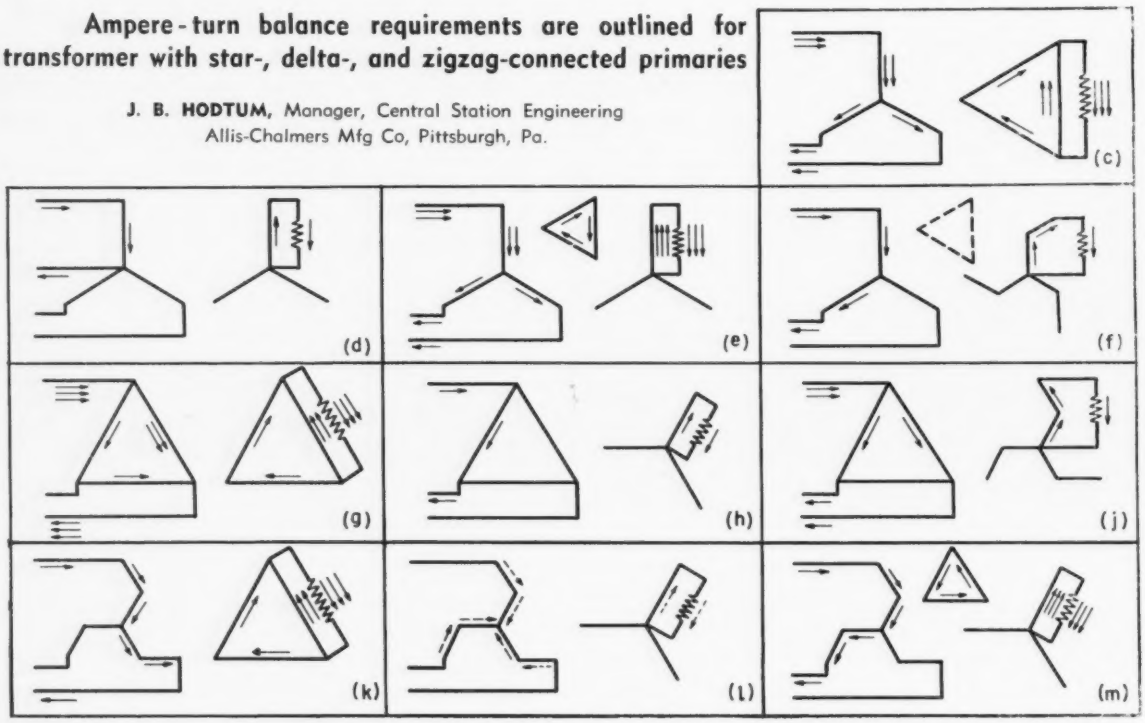
You can put your confidence in—

GENERAL ELECTRIC

Transformer Ampere-Turn Balance Requirements

Ampere-turn balance requirements are outlined for transformer with star-, delta-, and zigzag-connected primaries

J. B. **HODTUM**, Manager, Central Station Engineering
Allis-Chalmers Mfg Co, Pittsburgh, Pa.



Requirements for proper ampere turn balance are shown in the diagrams. Solid arrows indicate the flow of load current for a single-phase load on a three-phase connection. Dashed arrows indicate that load current cannot flow.

Conditions imposed are that the connection must supply a single-phase load phase-to-phase where the secondary side is delta connected or a single-phase load connected phase-to-neutral where the secondary is star connected. Connections (c), (d), (e) and (f) cover the conditions when the primary side is star connected.

For example, connection (c) indicates that the load requires three units of current two of which are supplied from one transformer and one unit from the other two transformers in series. The diagram indicates that the primary winding of the phase carrying the two units of current on the secondary side will likewise carry two units on the primary side. At the neutral point these two currents divide, one flowing in each of the other two phases on the primary side; therefore, one phase would carry two units of current, which are returned as one unit in each of the other two phases. The arrow unit indications in the primary and secondary are in opposite directions and always balance.

For connection (e) the three units of load current in the secondary winding are balanced by one unit in the tertiary winding and two units in the phase winding. Since the delta winding is connected in series, the same current has to flow through all three phases of the delta winding and this produces an opposing current in the other two phases of the primary winding as shown.

Connection (f) indicates that the delta tertiary winding is not required. Here again the voltage across the zig and the zag is not sinusoidal, but the voltage phase-to-neutral will be sine wave.

Connections (g), (h) and (j) cover conditions where the primary side is delta connected.

Connections (k), (l) and (m) cover conditions for zig-zag connected primary windings. Connection (l) cannot furnish load current since the flow of load current in the primary side of each phase winding is in opposite directions; and, therefore, cancels. A neutral connection on the primary side would not correct the condition. The proper solution would be the installation of a delta winding as shown in connection (m).

Notes

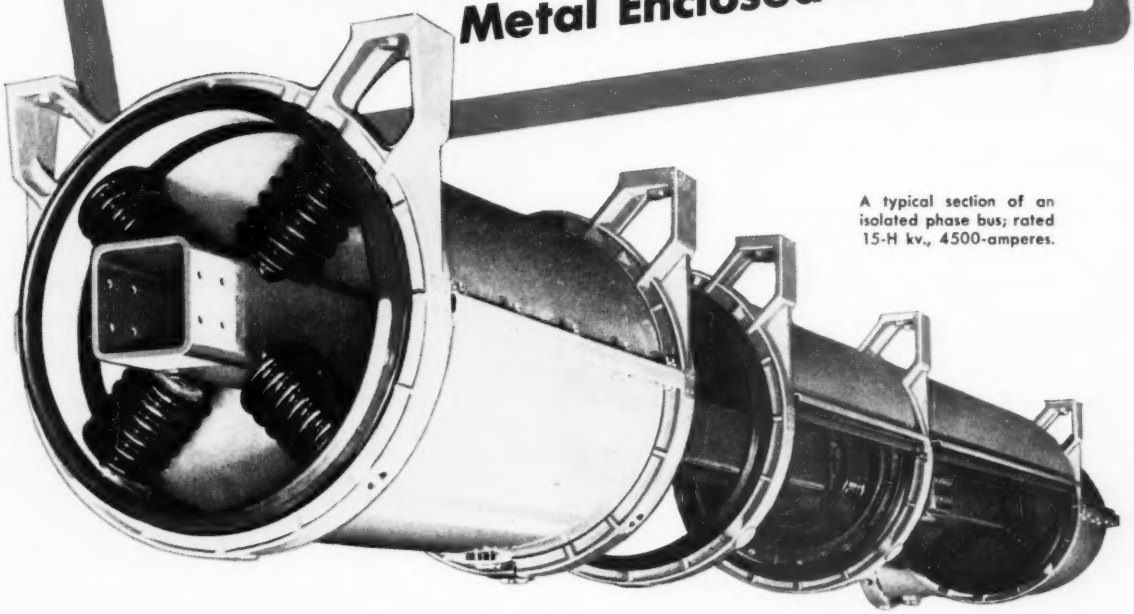
For ready reference the sublettering coincides with that in Engineering Reference Sheet No. 53-2 on transformer excitation connections, presented in the January 26, 1953 issue.

Diagram (f) indicates that the delta-winding is not required for load balance. However, the delta or primary neutral must be presented to satisfy excitation requirements.

In diagram (l) the condition is not improved by connecting the neutral of the zig-zag since the dashed arrows in each phase cancel out.

Parallel operation requirements will be outlined in an ensuing issue.

A DIRECT PATH TO BETTER PROTECTION with DELTA-STAR Isolated Phase Metal Enclosed Bus Runs



A typical section of an isolated phase bus; rated 15-H kv., 4500-amperes.

DELTA-STAR METAL ENCLOSED BUSES ARE AVAILABLE FOR ALL REQUIREMENTS

"Unit-type" metal-enclosed bus designs are available in a wide variety for isolated phase, segregated phase and non-segregated phase construction. Delta-Star's experienced engineers will make an analysis of your proposed installation and determine which type will be the most economical for your service requirements. Regardless of the type selected, you are assured of a design which will fit into your installation at lowest possible erection cost.

For complete information ask for Publication 5006.

Here is the safest direct path between generator and station bus or transformer. Absolute isolation of each phase eliminates the possibility of a phase to phase fault.

Phases individually isolated and enclosed. Bus is supported within heat treated cast aluminum rings by porcelain insulators which are always placed in compression both under normal load and in event of short circuit.

Aluminum Covers in identical halves with silvered channel shape edges provide strong sections for bolting and good electrical contact between halves. Specially shaped neoprene gaskets eliminate dust and moisture. Large area ring gaskets permit liberal misalignment of ducts without reducing seal. Covers easily removed for inspection.

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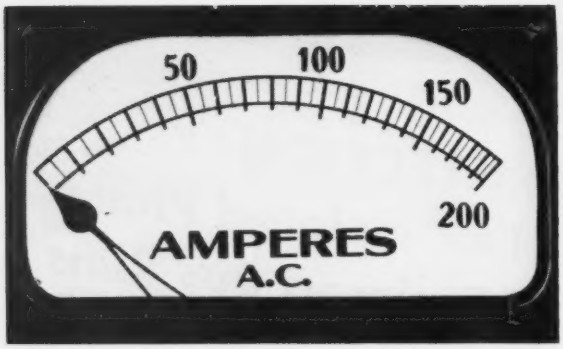


EXPANDED AMMETER SCALE at the lower end is obtained by cutting the pole pieces of a rectifier type ac ammeter

New Feeder Ammeters With Linear Scale

JOHN H. MILLER, Vice President, Weston Electrical Instrument Corp, Newark, N. J.

Iron-vane and similar instruments show no perceptible deflection on 1-2% full scale current, since the torque is proportional to the square of the current. However, light load conditions on feeder lines are useful indications of intact circuits with no open disconnects or breakers. To serve this function, Weston has developed a rectifier-type instrument that gives linear scale deflection on the entire range.

To protect the instrument from overloads, it is supplied with a nickel alloy core current transformer, where forty times normal primary current gives only double full scale secondary current. This transformer primary connects to the main feeder current transformer.

The instrument is a conventional dc meter with a small copper-oxide bridge rectifier and a suitable series shunt resistance network, the whole rated 100-ma and 30-v full scale. The scale is perfectly linear and definitely shows small feeder currents 1-2% full load, indicating operation readiness.

READABILITY COMPARISON of linear scale ac ammeters, located centrally, and standard feeder ammeters, on top and bottom

The instrument responds to average value but is calibrated in rms current. Resultant errors in substations are very minor.

By using cut pole pieces, the scale's lower end can be further expanded, if necessary, although substation practice does not require it.

Meter Wire-Storage Case Is Economical, Portable

ARCHIE C. MORLEY, LEWIS H. PAUL, Indiana & Michigan Electric Co, Buchanan, Mich.

A portable wire-storage case has been devised to save wire and time, and provide safe support for metermen.

This wooden case is suitable when making meter installations where current or potential transformers, or both, are included, and where as many as seven separate single No. 12 solid copper conductors of various coded colors are used. This kind of job occurs quite frequently and requires continuous transportation and storing of the wire in cars or trucks.

The wire is received on spools or in coils of 500-ft length. If retained in these forms, waste occurs when the wire is cut. Also the coils become tangled, kinked and dirty in transportation. Straightening and cleaning the conductors for installation is time consuming.

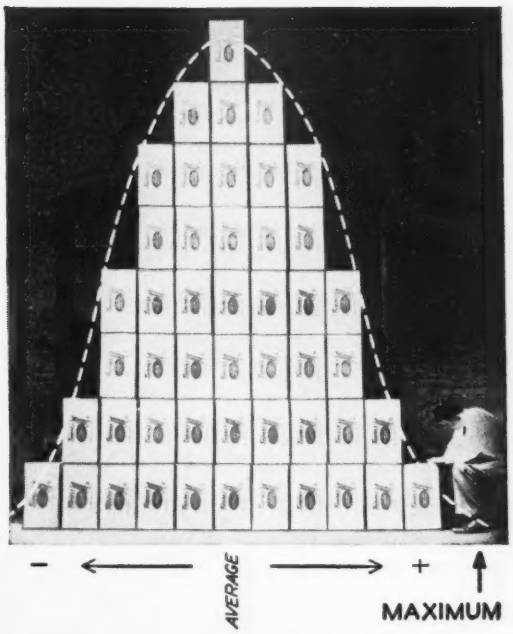
WIRE-STORAGE CASE is made of ½-in. thick fir plywood and holds 7 reels of wire

The case illustrated keeps the wires reasonably straight and clean, and makes it possible to cut just the length needed each time. Also the box can serve as a platform since many of the jobs are at a height of 7 ft, from the ground to some of the conductors.

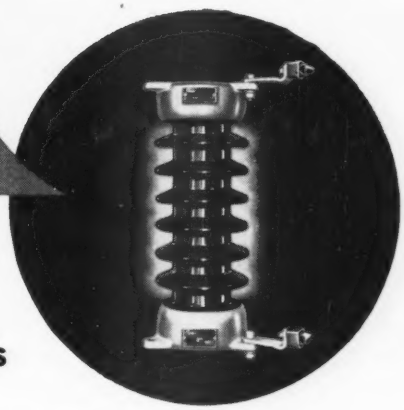
The case has been used satisfactorily for four years. At the time of construction the hardware, sheet metal, and wood cost $12; labor cost $6; or a total of $18.

The exterior of the case is made of ½-in. thick fir plywood. Cleats of ¾ in. x 1½ in. white pine are used in all corners, and on the bottom, front and back. All joints are glued and screwed. Screw holes on the outside of the box are countersunk and filled with plastic wood and then sanded smooth, before the case is painted.

The outside dimensions are 17-in.



Be on the SAFE SIDE



. . . specify O-B Maximum-Rated Thorex Lightning Arresters

Natural variations are inherent in any mass-produced product--including lightning arresters. How shall we recognize these variations in such an important protective device? To illustrate the problem, we have stacked 48 O-B Thorex arresters to represent the normal distribution curve of their IR discharge protective performance.

Only 16⅔ per cent fall into the central "average" column. Twenty cf these arresters, or 42 per cent, are on the plus side of average not as good as average protective-wise. Your chances are equal of getting a below-average unit versus an above-average unit. 'Way out on the plus end is an arrester -- the poorest that O-B factory inspection will pass. Yet this is the arrester O-B lists in its cataloged protective characteristics -- the MAXIMUM unit. We wouldn't bring the matter up if we were not proud of the tall, narrow distribution curve of O-B Thorex performance, indicating close tolerance resulting from precise manufacturing control; and making the *poorest* Thorex arrester still a new high standard. The remaining Thorex arresters are as good, and in practically all cases better, than O-B MAXIMUM listings state.

If you want to be on the safe side in lightning arrester specifications--if it's definite protection you're buying--you get this with a bargain thrown in when you install O-B Thorex lightning arresters.

Ohio Brass

MANSFIELD OHIO, U.S.A.

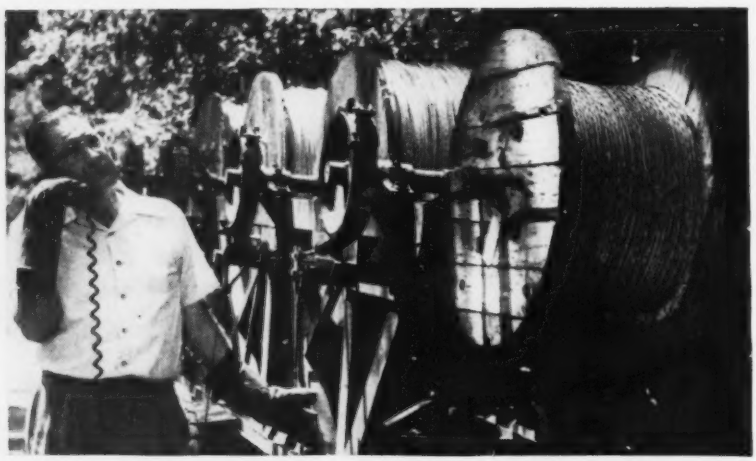
4236-H

square by 15-in. high. All pieces can be cut from a 4-ft x 3-ft sheet of plywood with some to spare.

The seven spools, which are 2-in. wide by 11¼-in. diameter, have a 6¼-in. diameter wood core with ends of No. 24 gauge sheet metal screwed to the core. A ⅜-in. hole through the center of each core accommodates the spindle.

One end of each reel is slotted to take the crank used to wind wire on the spools. The inner end of each wire is bent like a hook and held in a hole in the core. Wire is not wound too tight on the spools to prevent their ends flaring out and bearing against adjacent spools. A thick but small diameter washer placed between spools on the spindle helps avoid interference between spools.

Emergency Brake on Reel Holds Wire at Proper Tension



BRAKE IS ADJUSTED as wire is pulled in on poles carrying energized circuits. Rig carries four reels with a brake on each reel. Man setting brake uses walkie-talkie to keep in touch with winch operator at opposite end of "pull" to maintain proper tension

RUSSELL P. MILLER, Assistant Superintendent, Overhead Lines Division, Indianapolis Power & Light Co

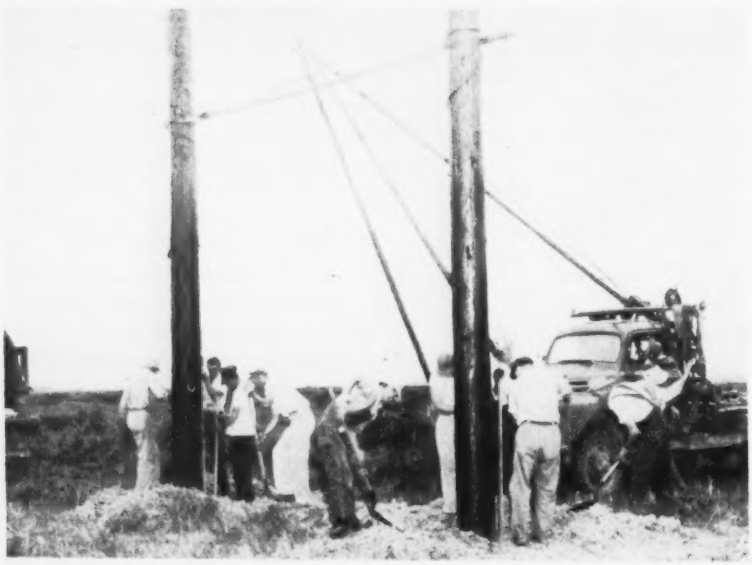
Indianapolis Power and Light Company's overhead lines division has developed a simple and comparatively inexpensive braking arrangement on wire pay-out reels. It consists of a simple brake drum arrangement, such as is used on automobiles, and an automobile type emergency brake lever.

A wire reel rig, that holds as many as four reels of wire, each equipped with a hand brake, is spotted at one end of a "pull." A truck with winch is placed at the other end, which may be half a mile away.

At the beginning of the pull the brake is set to give the desired tension. Usually it does not require any further attention. While the brake adjustment is being made the man at the reel rig is in touch with the winch operator on the truck with a walkie-talkie. Once the proper adjustment has been made the wire can be pulled in without having it sag down into any energized conductors below or whip up into a conductor above.

One wire is pulled in at a time. This brake is especially useful in pulling in wire on poles carrying energized high voltage circuits.

Yoke Cuts Pike Pole Work on H Frames



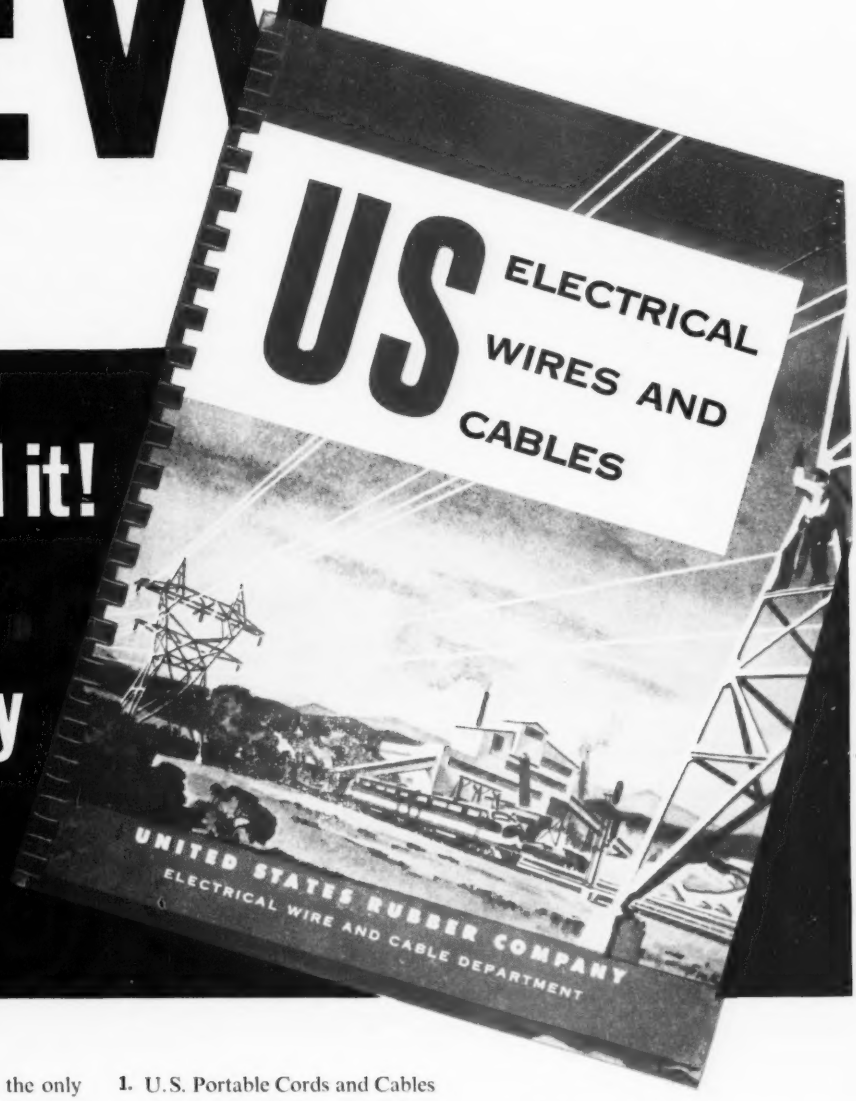
YOKE is tied loosely to poles and slipped upward about 15 feet high. This permits positioning the structure without using pike poles. Compressed air tampers are used

S. J. WARD, Superintendent of Substation Construction, Houston Lighting and Power Co, Houston, Texas

Pike poling is almost completely eliminated in H frame construction by letting the truck winch do all the work. When poles are in place a yoke is tied to each pole at the height of a man and then with ropes loosely around yoke and pole the A frame on the truck raises the yoke to a convenient positon, about 15 feet above the ground. Ropes are then run to the capstans on either side of the truck and slack is taken up.

With a rope to each pole at the yoke attachment and the A frame holding the center of the yoke, poles are held in proper positon in the holes during tamping. The two ropes plus the A frame attachment gives good control in the line direction. X-braces on the structure prevent side-

NEW



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United States Rubber Company, the only electrical wire and cable producer to grow its own natural rubber and to manufacture its own plastics and synthetic rubber, makes a complete line of electrical wires and cables for every industrial and domestic application. Just published is the 1953 "U.S." Catalog, essential for men who specify, install or maintain electrical wire and cable. Send for your free copy to address below. Here are the catalog chapter headings:

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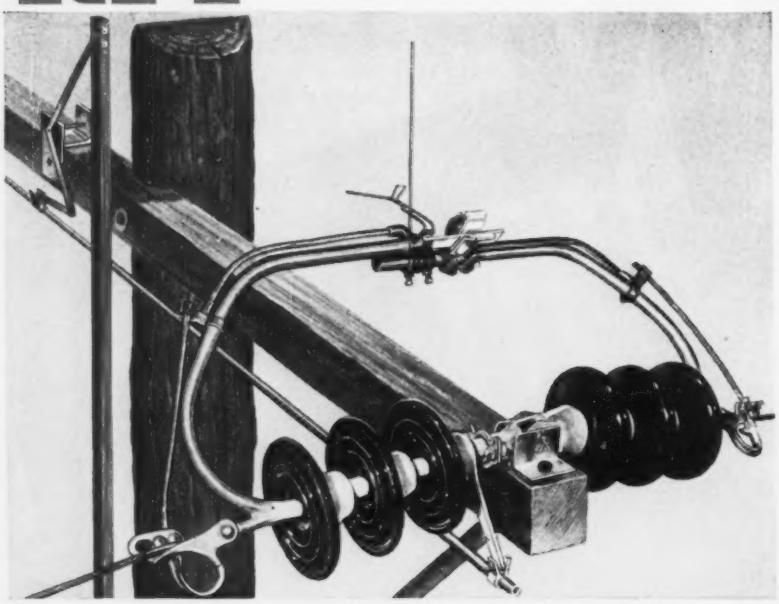
KPF POLE TOP SWITCHES



Simple design means more switch ...for less money!

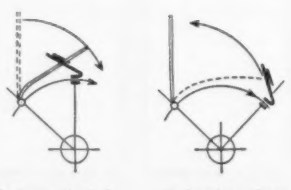
KPF Pole Top Switches cost less because they are simplest in design. They lower installation costs because they bolt on a single crossarm in minutes, require no extra insulators. KPF switches save, too, on upkeep; simple push-pull interphase rods never bind because of crossarm warpage; monel and bronze bearings never need lubrication.

KPF switches may be used in horizontal, vertical or triangular mounting. Free floating, self aligning blades and jaws maintain proper contact under all conditions of switch sag adjustment.

NEW QUICK-BREAK ATTACHMENT FOR KPF SWITCHES

The split-second breaking speed of these new KPF attachments means you can switch many circuits without using expensive circuit breakers. Attachment is available for all KPF switches rated 15 to 69 kv.

WRITE FOR DETAILS



Spring rod winds to full tension as switch opens.

Rod springs clear, breaking contact at high speed.

KPF ELECTRIC COMPANY

wise or right-angle movement.

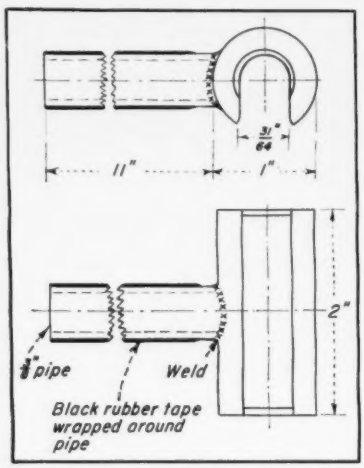
The yoke is made of an ordinary pipe with an angle iron welded to it in the center to form a yoke and give the required strength.

Compressed air tamping lessens this part of the work, gives a better tamping job than is possible by hand and reduces the time required.

Pair of Wire Benders Aid Substation Grounding

JAMES H. CRAVENS, Substation Electrician, Indiana & Michigan Electric Co, Marion, Indiana

A pair of hand tools, fabricated from scrap material, reduce the effort and time required in bending grounding wire. The wire benders shown are



BENDER and a duplicate form a pair used for straightening or bending 4/0 solid wire

designed for 4/0 solid soft-drawn wire used in grounding systems of substations.

By slipping the two benders over the wire opposite each other, kinks can easily be removed by pushing on one tool and pulling on the other. Thus straight sections of wire will have a neat appearance. Right-angle and U-bends in the wire, as at steel structures and transformers, can also be made easily and uniform.

Calibrated Face Speeds Sag Checks

Use of a stop-watch with a face calibrated directly in amount of sag speeds the job of checking sag in the field. Watch is used by California Electric Power Co engineers who

Dispatcher takes data received on Speedomax Load Recorders, left, and uses it to control system generation with console, extreme right.

25 years of systematic development...

reflected in industry-wide adoption of L&N Load-Frequency Control

Interconnected operation of power systems has resulted in improved reliability, economical interchange of power, and greater operating flexibility. These advantages, which are so important in planning for future load growth, are possible because of two basic techniques which have evolved from years of operating experience:

1. the load dispatcher for each system is given immediate and complete information concerning load and generation conditions in that system.

2. each system absorbs as much of its own customer load changes as possible.

Leeds & Northrup system control achieves these two operating techniques because L&N progress has been "in phase" with changing utility operating requirements during the past 25 years. Speedomax Telemeters bring an almost instantaneous appraisal of system load facts to the load dispatcher's attention; L&N Load-Frequency Control automatically regulates the system's generating plants to maintain desired schedules of net power flow into or out of the system.

And L&N equipment is backed by field engineers who have extensive experience in power plant applications. Whether yours is a small utility, or a large one—interconnected or isolated—L&N equipment and engineering are ready to help you prepare for future load growth.

For details, write to 4938 Stenton Avenue, Philadelphia 44, Pa.

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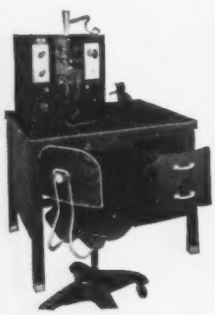
Two position Test Table with photo-electric controls. Designed to obtain maximum output with this type of control.



Form FHAPBL

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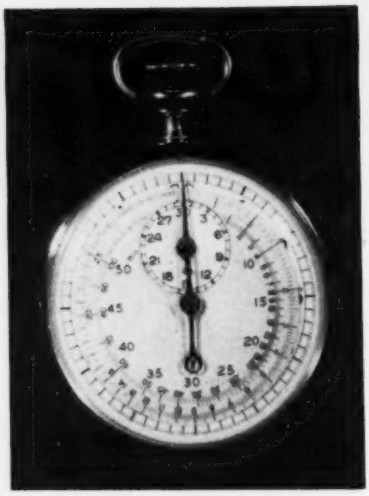
check sag by throwing a line over the conductor, giving the line a jerk, and counting simultaneously the time and number of returning waves, usually five or ten.

Face is calibrated to tenths of a foot and eliminates use of a standard time-sag table to convert time to inches of sag. Outer scale on the new face gives the sag for ten vibration returns; middle scale gives sag for five vibration returns; inside scale gives time in seconds. Calibrations for five returns is based on the formula, $D = 0.0402T^2$, where D is sag in feet and T is time in seconds.

Calibrated faces for five watches were made by drawing the calibrations on a sheet about 10 x 20 in. Photographs of the drawing were reduced to prints of the proper size. They then were glued to the watch faces by a jeweler. According to H. M. Williams, Inspector of Overhead Lines, the recalibrated watch is accurate enough for all checks except on new lines or where a precise check of sag must be made.



RECALIBRATION of stop-watch face reads sag of conductor directly in tenths of a foot. Use of this watch eliminates need for taking standard time-sag table into field

Time sag tables, the basis of the calibrated watch face, are obtainable from conductor manufacturers on request.

Pole Dolly From Landing Gear

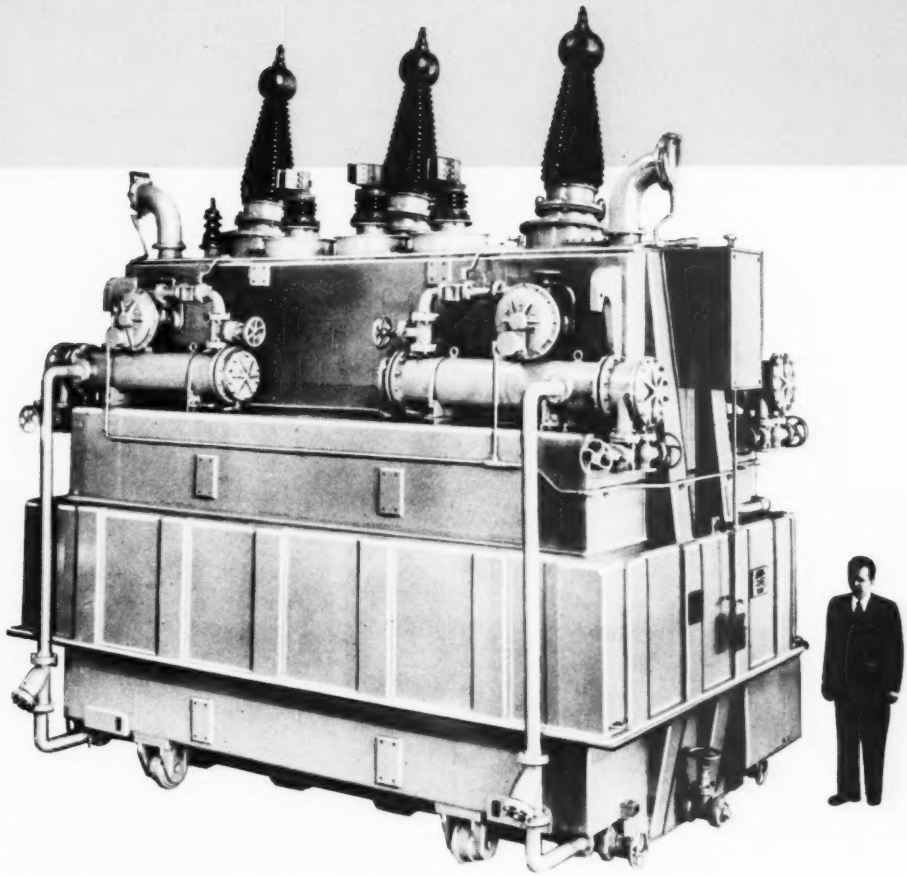
LANDING GEAR from an old plane has been converted by Indianapolis P&L Co to the hauling of poles to inaccessible places . Equipped with regular airplane tires, this dolly permits crossing of lawns without damaging them, and hauling poles easily into locations not conveniently accessible to regular line trucks.

Added to the landing gear is a six inch channel, on which the pole rests, and a chain equipped with take-up device to hold the pole securely. Under ordinary circumstances one man can balance pole and move it to the desired location.

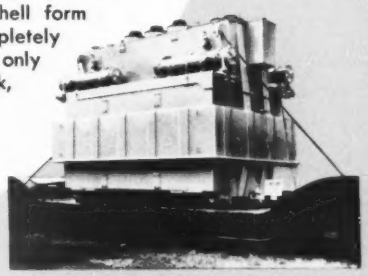
105,000 KVA

THREE PHASE • CONTOUR DESIGN

Pennsylvania Power Transformer



The function of this 105,000 Kva Pennsylvania Power transformer is to step up the generator voltage of 13,200 volts and transmit it at 115,000 volts . . . The transformer traveled by train to its destination in an upright position, completely assembled except for bushings. The space-saving shell form construction of the core and coils made this possible . . . Completely assembled and filled with oil, the transformer weighs only 252,000 pounds. Due to the Contour Design of the tank, less than 7000 gallons of oil were required . . . The transformer measures 172 inches to the top of the bushing casings and has an overall height of 231 inches.



PENNSYLVANIA TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PA. • *Greater Pittsburgh District*

SEE NEXT PAGE FOR INSIDE STORY

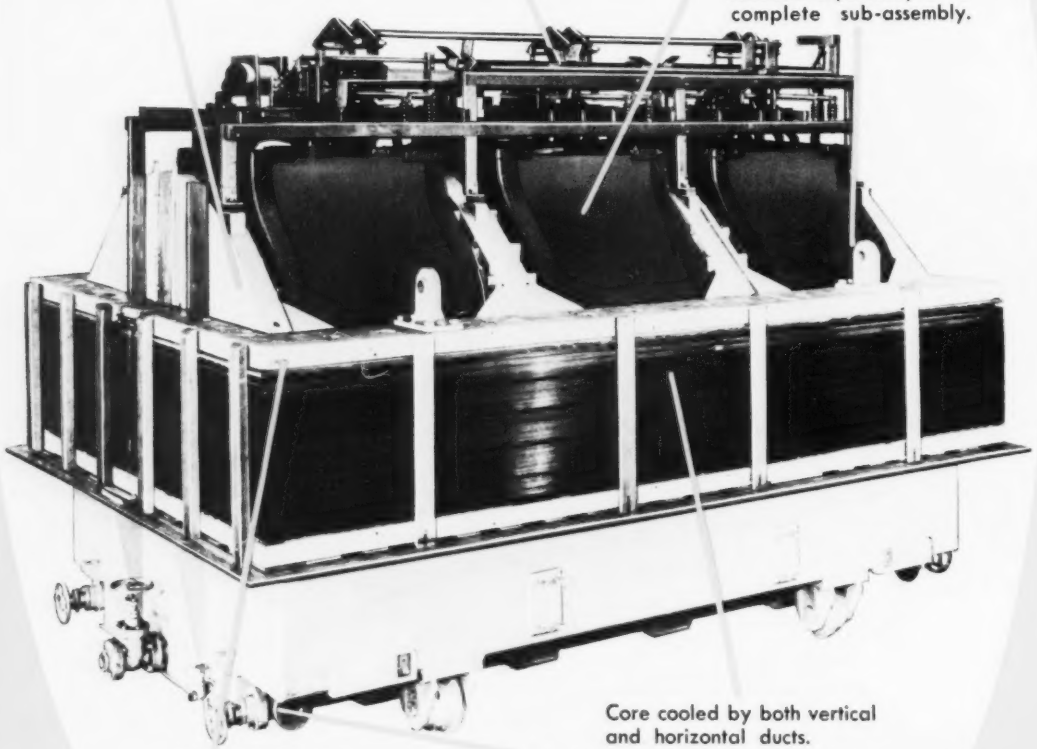
Inside a 105,000 KVA THREE PHASE • CONTOUR DESIGN Pennsylvania Power Transformer

Core and coils clamped together with heavy steel frames to form a rigid structure.

Straight line tap changer with silver alloy contacts is located above the core and coils where it is accessible through manholes for inspection and maintenance.

To assure efficient cooling throughout the coils, all cooling ducts are in a vertical position.

Core and coil unit can be handled separately as a complete sub-assembly.



Core cooled by both vertical and horizontal ducts.

Heavy box sections form part of core frame and clamp coils against short circuits.

Transformer is cooled by means of four water-cooled heat exchangers. Two heat exchangers are in operation up to 70% of load. Above 70% load, all four heat exchangers operate.

105,000 Kva, three phase, 60 cycles, 55°C. Temperature rise. Forced-oil-cooled with water-cooled heat exchangers. High voltage: 115,000 volts Grd. Y. Low Voltage: 13,200 volts Delta.

PENNSYLVANIA TRANSFORMER COMPANY

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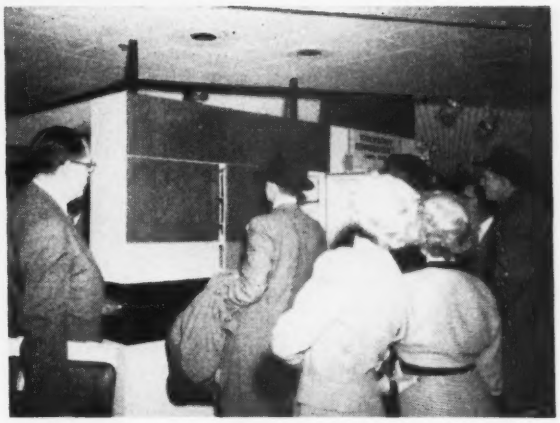
For exterior view of this transformer, see other side.

Two apartment model freezers, of upright design and 7 cu ft capacity, are shown by Charles F. Pearson of Gibson. These freezers are available with right and left hand doors and are shown as a pair with the idea that one can be purchased and a second added later



General Electric's model of the "Refrigerator of Tomorrow" attracted crowds. The 10 cu ft capacity refrigerator-freezer is only 14 inches from front to back, has doors on both ends, is styled like a kitchen cabinet and sets on 10-inch pedestals on the kitchen work surface

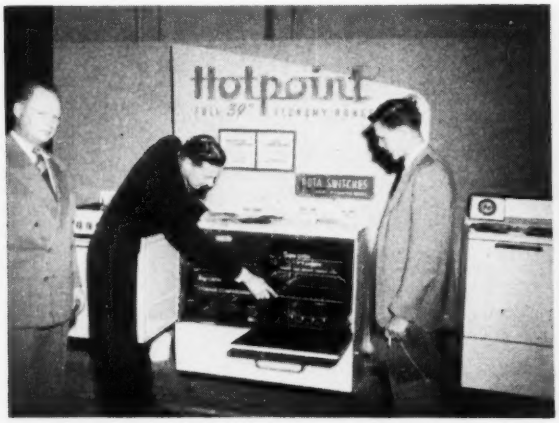
Change: That's Appliance Show Motif

Evidence that appliance design is far from static was apparent at Chicago show. 1953 lines embody many new developments

More and greater changes in appliances and appliance lines were apparent at the January show in Chicago this year than at any time since pre-World War II. A kitchen-cabinet-style model of a refrigerator-freezer of the future designed to stand above a kitchen "island," was shown by General Electric. An automatic ice maker was featured in Servel's refrigerator-freezer models. New and improved defrosting methods were directed at making the job easier for the housewife and doing it faster for the protection of frozen foods. Numerous upright freezer models were in evidence. The Bendix combination automatic washer and dryer was the most conspicuous development in this field. Bendix has also added a full line of appliances, ranges, refrigerators, and freezers, to the laundry equipment shown in the past. Kelvinator has added a full line of laundry equipment to its range and refrigerator line of past years.

Westinghouse showed a portable automatic dishwasher that could be installed permanently later by removal of casters, also a buffet-style deep-fat fryer that attracted considerable attention. Hotpoint and General Electric ranges featured larger ovens, one very high speed surface unit and a plug-in immersion element that makes the deep well available for deep fat frying. Frigidaire exhibited two new room coolers, each with two complete compressor units. The idea is to cut down motor starting current.

CONTINUED ON NEXT PAGE



A. L. Walker, Hotpoint, shows new range with large oven. Range also has a super-fast surface unit

Ria Aubrey, Westinghouse, served visitors with tasty tidbits as she demonstrated the new buffet style deep fat fryer

Automatic ice maker, incorporated in Servel electric refrigerator-freezer, is shown by E. E. Cunningham. Machine has tap to water pipe, makes up to 15 lb of ice, seven pieces at a time, and dumps into basket, shutting off automatically when basket is full

Bendix "Duomatic" washer-dryer is shown by Clara Stone of Bendix. The combination washer-dryer fits a space only slightly larger than that required for one unit, costs less than two units, and goes through complete washing and drying cycle automatically

A. A. Timpson of Good Housekeeping Shops, Oakland, Cal, and Preston Cherry of Amana inspect Amana's 18 cu ft freezer

M. R. Rodger, Crosley, shows his company's new double oven range which features seven-heat controls

Robert E. Lee of Admiral shows double rubber gasket on refrigerator-freezer doors which prevents injury to slammed-on fingers

Marshall Hanson of American Kitchens, in barker's garb, explains revolving top tray of American's dishwashers

ICE CAN MAKE A "HOT LINE" COLD

IF SUSPENSIONS CAN'T STAND THE STRAIN!

Purified Porcelain is good insurance against the hazards of winter. This finest insulator porcelain ever made has unequalled ability to stand stress and strain. Cement is specially compounded and caps and pins are scientifically designed for maximum strength. Victor insulators withstand pull of ice, snow, high winds and endure thermal variations far above NEMA standards. For engineering data on these and other Victor *Purified Porcelain* insulators, send for Bulletin No. 4.

Every Victor Suspension Insulator undergoes this routine tensile test before electrical flashover test.

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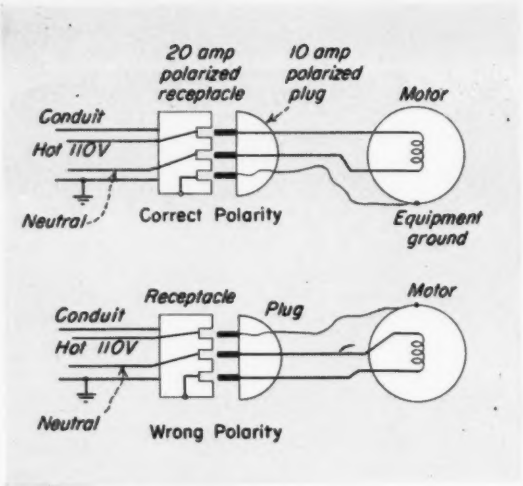
Shooting Industrial Plant Troubles

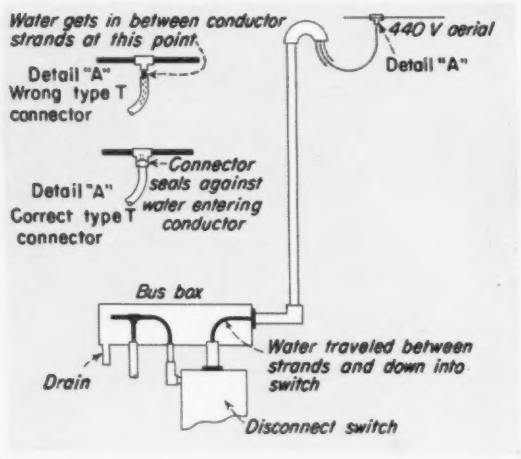
J. R. MILLER, Superintendent, Electrical Div, Polychemicals Dept, E. I. Du Pont de Nemours & Co Inc, Sabine River Works, Orange, Texas

Hazards with polarized plugs and cluttered poles, troubles with condensation in generators, moisture in electrical equipment and stray currents in motor bearings are among the problems that have been faced by the author in the past five years at E. I. du Pont's Sabine River Works at Orange, Texas. How these troubles were solved is told in the accompanying pages



Three-Pole Polarized Plugs . . .

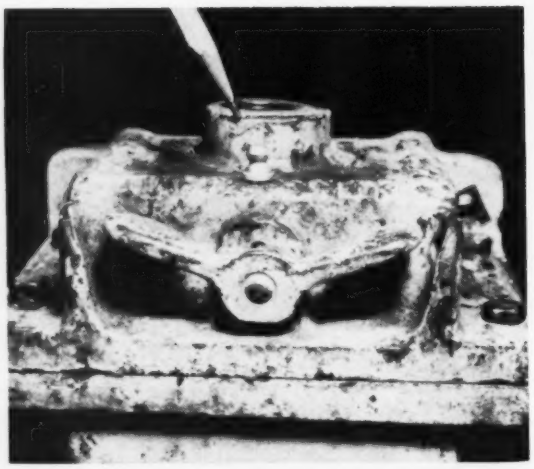
At Sabine River 20 amp, three-pole polarized plugs and receptacles are standard. The 10 amp plugs and receptacles have been eliminated for safety reasons. Some makes of 10 amp plugs can be plugged into 20 amp receptacles without maintaining proper polarity. Reversing polarity would place the frame of the portable equipment 110-v above ground.


Water gets in between conductor strands at this point.
440 V aerial
Detail "A"
Detail "A" Wrong type T connector
Detail "A" Correct type T connector
Connector seals against water entering conductor
Bus box
Water traveled between strands and down into switch
Drain
Disconnect switch

"T" Connectors . . .

Several electrical failures resulted because rain water entered electrical equipment, even though the conduit entering the equipment was properly sealed against moisture. In all cases the cables were connected to aerial lines and the rain water traveled between the strands of the cables and into the equipment causing failure and quite frequent interruption to the power service.

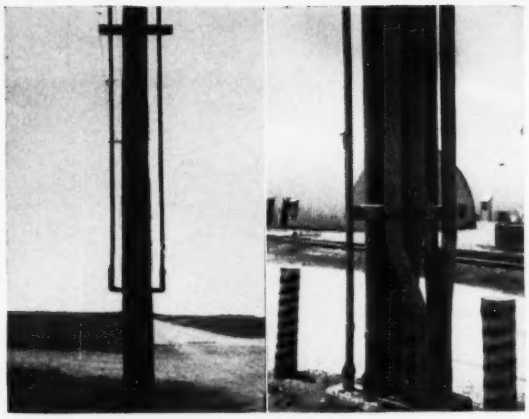
When the specified "T" connector was installed correctly it prevented water from entering at this point. The solution was to see that the correct connector was used properly at all times.



Corrosion . . .

At times the operating shafts on oil-immersed push buttons for motors "freeze" as a result of corrosion in the damp salty Gulf Coast area. A number of motor failures have been attributed to push buttons freezing in the "on" position. Overload devices could not shut the motors down when they were overloaded. To solve the problem grease fittings were installed to lubricate operating shafts of all push buttons in corrosive areas.

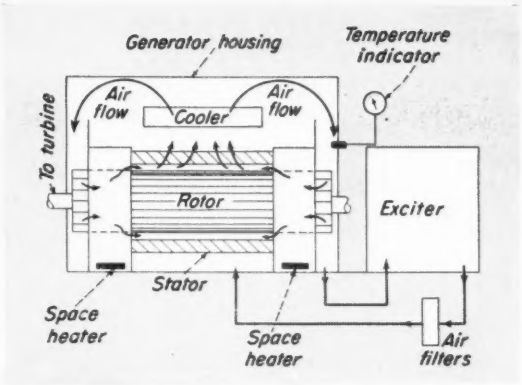
Grease fittings have also been used on switch operating shafts in switch condulet covers. These fittings are greased twice each year.



Climbing Space . . .

Lighting circuits of 115/230-v, and 440-v power circuits are on the same overhead pole lines and several conduits are frequently run on one pole to bring these services into buildings. In a few instances poles became covered with conduits, cables, boxes, meters and other equipment. There was no space for safe climbing.

The problem was solved by spacing conduits 12 in. to 24 in. away from the pole and securing them to the pole by means of supports. Thus at least 2/3 of the circumference of the pole is clear for safe climbing.

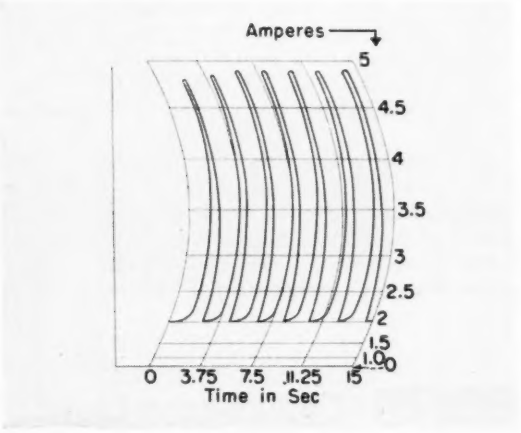


Condensation In Generators . . .

Turbogenerator units, 2,500 kw, 6,900 v, occasionally showed considerable condensation when shut down. Apparently condensation formed in the totally-enclosed air circulating system if units were shut down before cooling water in the exchanger was shut off.

This allowed temperature of air circulating inside generator to drop below outside ambient temperature.

The problem was solved by regulating the cooling water and turning on space heaters installed at the proper locations to keep air in the generator 5 F above outside ambient temperature.

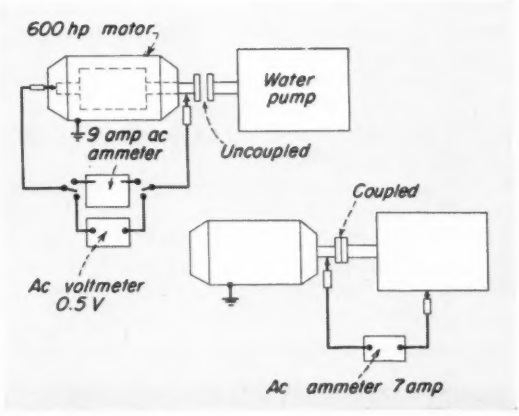


Motor Overload Protection . . .

Several winding failures occurred in a group of motors in the same service. In all cases the magnetic overload protective devices did not shut the motors down before the windings became hot enough to fail. A recording ammeter placed in the motor circuit showed the load to be of the cyclic nature shown.

Overload on the motor did not last long enough to trip the magnetic overload device which operated in inverse time. The overload did occur frequently enough to cause motor to overheat and burn the windings.

Magnetic-type overload devices were replaced with a thermal type and no trouble has been experienced since.



Bearing Failures . . .

Ball bearing failures on three 600 hp, 1,200 rpm, 6,600-v, three phase, induction motors on water pumps were traced to overheating caused by stray currents. As much as nine amperes of 180 cycle current would flow through the motor shaft when the pump was uncoupled and ends of the motor shaft short circuited. Voltage between the ends of the motor shaft measured 0.5 volts. When the motor frame ground was removed and the motor insulated from ground, stray currents still existed in the motor shaft.

As a temporary expedient, it is planned to install insulate bearing cartridges in the motors to prevent the flow of current through the bearings.

Pneumatic Lift

Consists of a crow's nest mounted on a rotatable boom that can be controlled either at the crow's nest or from the tractor. Its capacity provides for one or two man operation in one or two nests. Air for operating tools such as drills, sprays and grinders is available through an air hose installed inside the boom.

Characteristics of the Sky Lift are as follows:

1. Load capacity of the crow's nest is 500 lb.
2. Working reach for an average man is 28 ft from the center of the turret.
3. Working height above the ground for an average man is 37 ft.
4. Rotation of the boom is 370 deg.
5. Total weight of the lift and tractor is 9,000 lb.

Schramm Inc, West Chester, Pa.

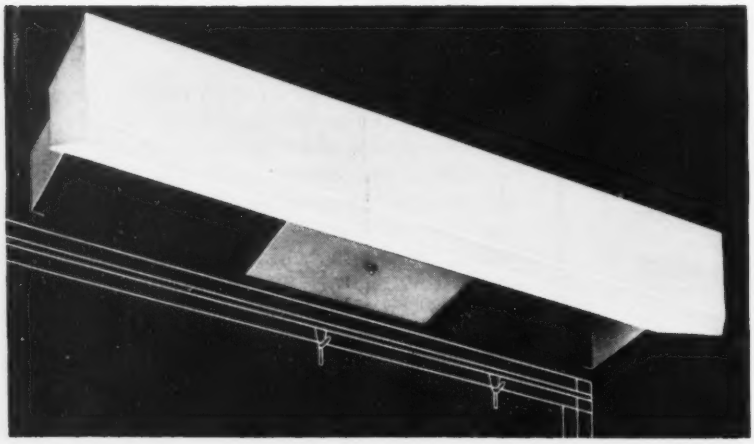
Transformer Welder

Featuring stepless current selection from 40 to 375 amp for applications from sheet metal work to high-current industrial jobs. It incorporates an enlarged scale and finely threaded screw adjustment for current selection.

Arc-stabilizing capacitors in the re-designed equipment claimed to increase production by enabling the operator to strike and maintain an arc without popouts. Silicone insulation is used as it withstands high coil temperatures well.

The welder is built with studs at the base to simplify connecting electrode and work cables. Power-factor correction capacitors claimed to assure low power costs. The welder is 36-in. high, 21-in. in dia and weighs 328 lb. It accommodates electrodes from $\frac{3}{32}$ to $\frac{1}{4}$ in. dia.

General Electric Co, Schenectady 5, N. Y.

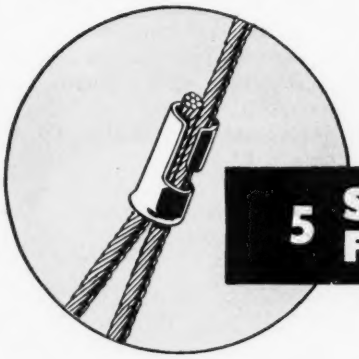


Chalkboard Light

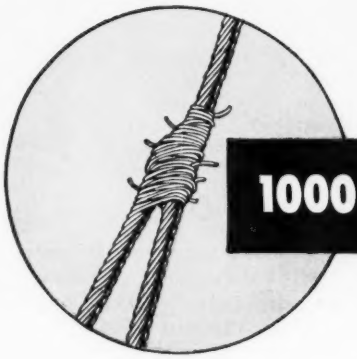
Designed to give maximum illumination from the top to the bottom of chalkboards without any glare. The Chalkboard Dean utilizes a parabolic trough reflector placed along the top of the board with a single row of fluorescent lamps. Inside surfaces of the reflector are highly polished and the outside can be painted the same color as the wall.

The lamp and reflector are so arranged that the direct rays of the lamp illuminate the top of the board and maximum output of the reflector

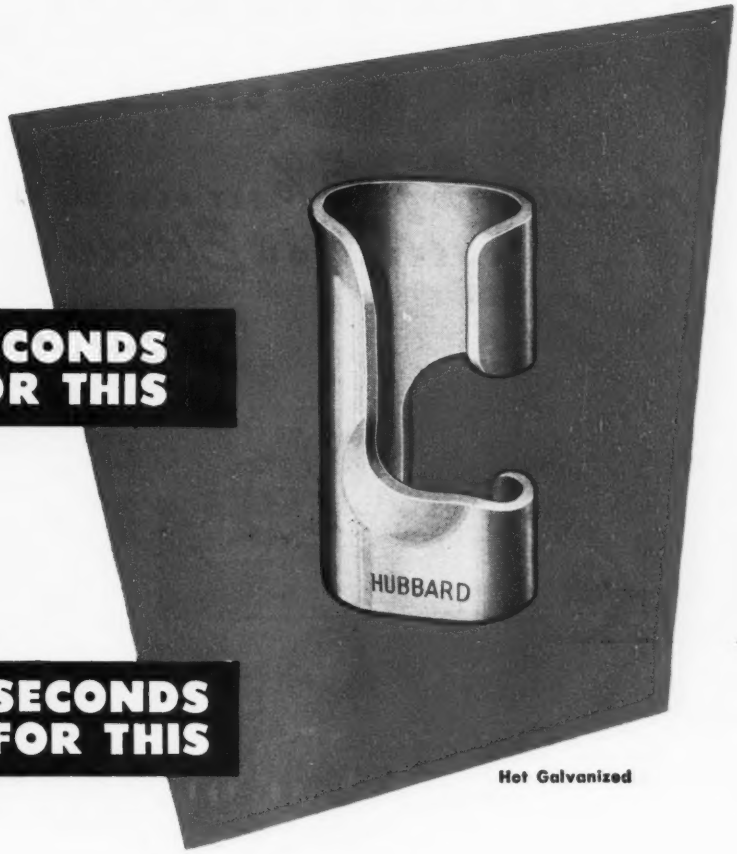
WHICH?



5 SECONDS FOR THIS



1000 SECONDS FOR THIS



Hot Galvanized

Write

FOR THESE SAMPLES...

or, look in your next shipment of Hubbard Guy Clamps for an envelope containing several ServiSleev samples. Try them . . . see how perfectly simple and simply perfect they are.

SERVISLEEVS
Make the Difference!

The cost of servicing a guy wire by wire wrapping is many times the cost of a ServiSleev . . . and the result is an awkward, bungling, unsightly job, dangerous to the lineman while installing, and forever afterwards.

ServiSleevs are applied in less time than it will take you to read the next sentence. Slip the ServiSleev over the guy wire, belled end toward the clamp; tap it with a wrench or pliers, and you have a neat, safe, and permanent installation.

Millions of ServiSleevs are in use throughout the world. They have made the wrapping of loose guy wire ends as obsolete as surreys and high button shoes.

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ESTABLISHED 1843

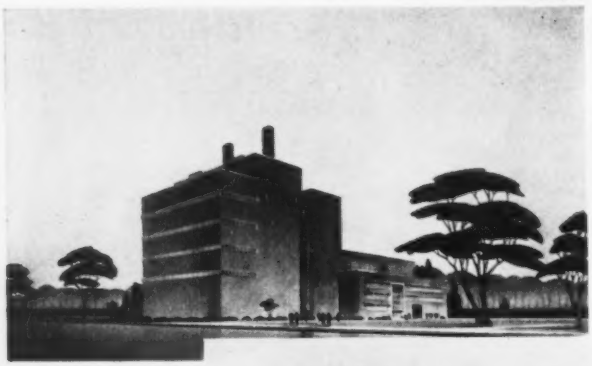
PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"

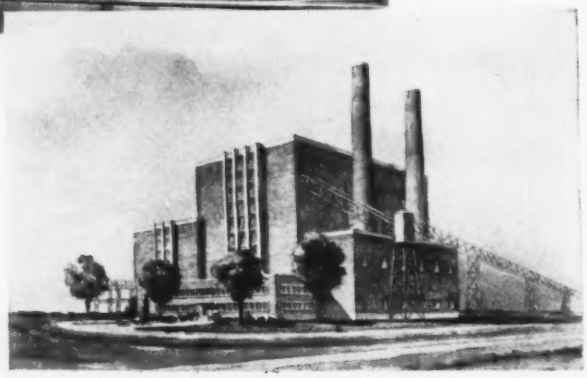
ON THESE TWO INSTALLATIONS

the AEROTEC SERIES

Assures 97.5% FLY ASH COLLECTION Efficiency



LEFT: The 264,000 kw (four units) J. Clark Keith Generating Station of The Hydro-Electric Power Commission of Ontario at Windsor, Canada. H. G. Acres & Co., Niagara Falls, Ontario, Consulting Engineers.



RIGHT: The 400,000 kw (four units) Richard L. Hearn Generating Station of The Hydro-Electric Power Commission of Ontario at Toronto, Canada. Stone & Webster Engineering Corp., Boston, Mass., Engineers and Constructors.

Here's on-the-job proof that Aerotec Series Mechanical-Electrical Dust Collectors are used for continuous efficiency. Guaranteed 97.5%, at normal full load the overall efficiency is anticipated as high as 99% at these two Canadian generating stations of The Hydro-Electric Power Commission of Ontario. Aerotec Series Collectors serving each plant combine a design 3RAS Mechanical and an Electrical Precipitator.

In the Mechanical unit, small diameter, permanent molded aluminum tubes provide high efficiency. Exclusive Aerotec pocket type collecting electrodes in the Electrical Precipitator reduce reentrainment of dust in the gas stream, contributing to a sharp improvement in stack appearance. The combined actions of these units assure maximum dust collection efficiency. Many Aerotec Series installations verify that fact.

Your plant can eliminate dust nuisances with Aerotec equipment just as many well-known companies have done. This highly successful performance is a reliable measure of Aerotec ability to solve your dust collection problems. Write our Project Engineers today!

Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONNECTICUT

(*Offices in 38 Principal Cities*)

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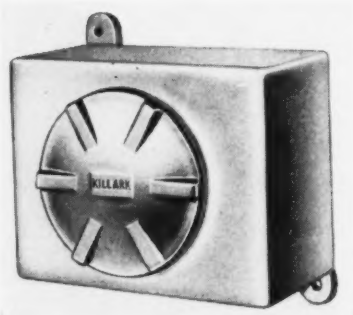
THE AEROTEC CORPORATION

GREENWICH, CONN.

is directed to the bottom. The size of the specular aluminum parabolic reflector is such as to amplify the bare lamp candlepower by about five times in the direction of the parabolic axis.

Maintenance is at a minimum as the reflecting surfaces are facing downward. The tubes are claimed to be shielded to 60 deg from the classroom side.

Solar Light Manufacturing Co, Chicago 7, Ill.



Junction Box

Identified as Type GRJ measures 10x8x5¼ in. and is explosion-proof. Features and installation advantages include: Alumalloy is used in the construction of the box. Alumalloy is rustproof, corrosion-proof, non-sparking and is strong while at the same time light in weight.

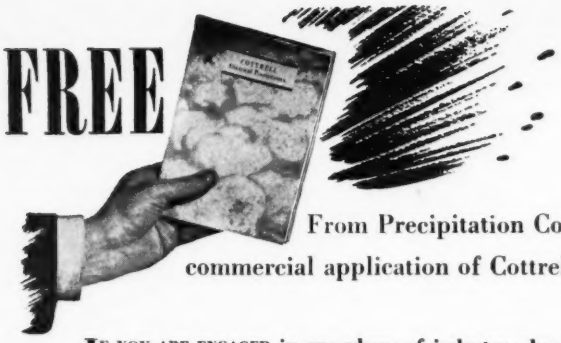
The GRJ will take conduit up to and including 3-in. sizes. It can be supplied with hubs in any location, and permits easy installation and quick, convenient splicing.

Killark Electric Manufacturing Co, St. Louis, Mo.

Street-Light Cable

Is plastic insulated for 600v between conductors and 6,000v to ground. Other voltage ratings can be supplied. The cable consists of two flexible stranded conductors, each insulated with Densheath (PVC), one black and one white, laid parallel and

FREE



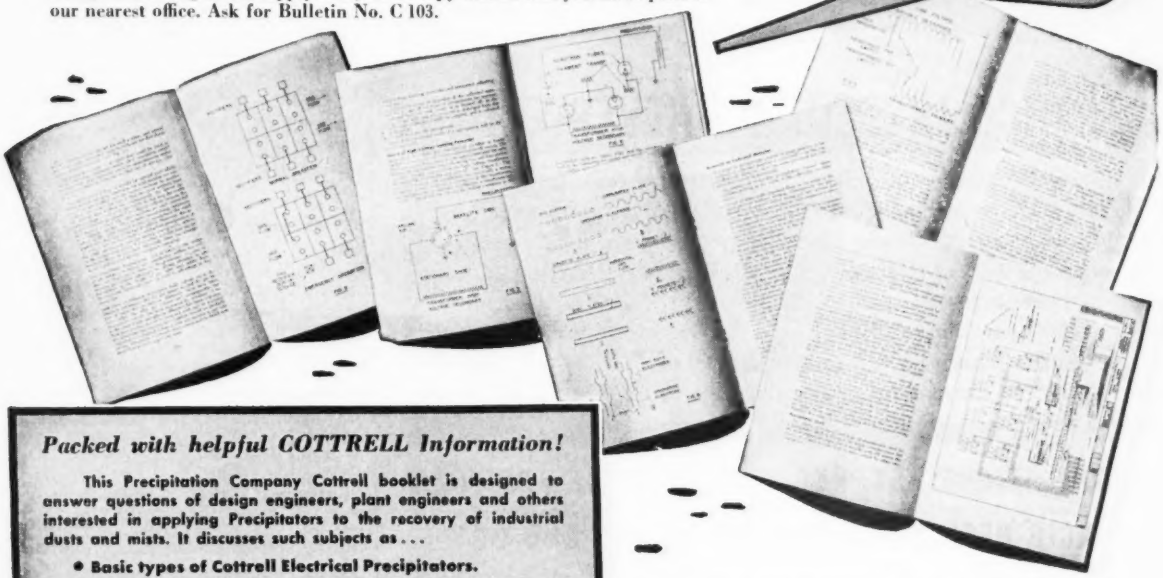
From Precipitation Company—the organization that pioneered the commercial application of Cottrell Precipitation...

IF YOU ARE ENGAGED in any phase of industry where the recovery of dusts, fumes, fly ash, mists, fogs or other suspensions from gases is a problem, you will find this booklet on the COTTRELL Electrical Precipitator helpful and informative.

Precipitation Company pioneered and installed the first commercial application of the well-known COTTRELL Electric Precipitator—Dr. Cottrell, the inventor, being a member of the company. And for more than 43 years Precipitation Company has consistently led in developing new COTTRELL advancements and techniques for recovering suspensions from gases, both wet and dry.

This free 28 page booklet summarizes many of the basic facts you should know about modern COTTRELL Precipitators—the various types available, how they operate, principal types of electrode systems and rectifiers, shell constructions, etc. As long as the supply lasts, a free copy will be sent you on request to our nearest office. Ask for Bulletin No. C 103.

28 PAGES
of helpful facts to know about
COTTRELL ELECTRICAL PRECIPITATORS



Packed with helpful COTTRELL Information!

This Precipitation Company Cottrell booklet is designed to answer questions of design engineers, plant engineers and others interested in applying Precipitators to the recovery of industrial dusts and mists. It discusses such subjects as...

- **Basic types of Cottrell Electrical Precipitators.**
- **Principal parts of a Cottrell Precipitator.**
- **Mechanical and Electronic Rectifiers.**
- **Various types of Collecting Electrodes (rod curtains, corrugated plates, dual plates, pocket electrodes, etc.).**
- **Removal of Collected Material.**
- **Factors in Shell Construction (steel, concrete, brick, etc.).**
- **Operating Efficiences and the Effect of Various Factors on Performance.**

...and many other basic Cottrell facts. Write for your free copy of Bulletin C103 today while supplies are adequate!

The above typical pages indicate the type of technical data and helpful illustrations contained in this booklet on COTTRELL Precipitators—data based on over 43 years of development work and first-hand engineering experience originating with the first commercial application of COTTRELL equipment.

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COTTRELL Precipitators
MULTICLONE Collectors
TURBULAIRE Spray Dryers

...in all parts of Canada and other countries.

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BERMICO INSPECTION NEVER ENDS—

For over 25 years, our quality control men have inspected every length of BERMICO Conduit from top to bottom, inside and out—looking for flaws. If there's the slightest defect, the conduit is rejected at once.

That's just one example of the care taken to insure BERMICO's high quality from raw material to finished conduit.

Made by Brown Company from sturdy wood fibre, impregnated with pitch, BERMICO Electrical Conduit is—

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For surest cable protection, be sure to specify

BERMICO® FIBRE CONDUIT

distributed by
WESTINGHOUSE
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offices in principal cities

BROWN COMPANY, Berlin, New Hampshire
BROWN CORPORATION, La Tuque, Quebec

SOLKA & CELLATE PULPS • SOLKA-FLOC • NIBROC PAPERS
NIBROC TOWELS • NIBROC KOWTOWLS • BERMICO SEWER
PIPE, CONDUIT & CORES • ONCO INSOLES • CHEMICALS

jacketed in black polyethylene.

Cable is available in the following sizes: No. 10 Awg—19 strands, No. 8 Awg—37 strands and No. 6 Awg—37 strands.

Manufacturer warns that suitable methods should be used for termination at the fixture to prevent high temperatures from damaging the cable. **Anaconda Wire & Cable Co, New York, N. Y.**

Pressure Control

Designated as Cat. 101P Controls, are applicable for very low pressures where regulation is required in in. of water, it is claimed. Employing a silicone impregnated glass cloth diaphram to permit operation in high or low temperature, the control can be used on the exhaust side of a fan to detect fan failure.

Standard ratings ranging from 0 to 20 in. of water pressure with range adjustment and fixed differential from 0.2 to 2 in. water are available. Electrical ratings are approved by Underwriter's Laboratories for 10 amps at 125v or 5 amps at 250v ac.
The Henry G. Dietz Co, Long Island City, N. Y.

Shovel-Crane

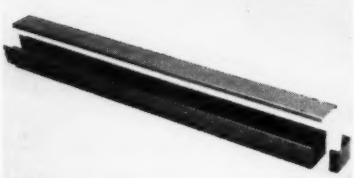
Rated at six tons capacity, the new ⅜-yd model T-35 has a complete line of attachments including shovel, clamshell, dragline, hack hoe and pile driver.

Major improvements claimed over previous machines include: A stronger main frame with 54% increase in sec-

tion modulus, larger shafts and bearings throughout, bigger diameter center pin, newly designed trunnion base with wider trunnion rollers and the use of four adjustable cam-type hook rollers instead of three.

The T-35 can be mounted on any tandem axle truck having a wheelbase of 164 in. or more.

Schield Bantam Co, Waverly, Iowa

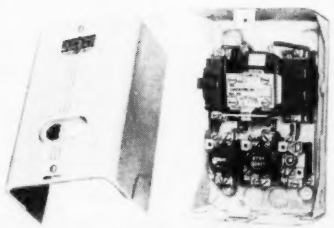


Wireway

For use with meter boards, service boards, load side switches, etc. They are 2½-in. square, and are available in 1, 2, 3, 4 and 5-ft lengths with or without ½-in. and ¾-in. conduit knockouts.

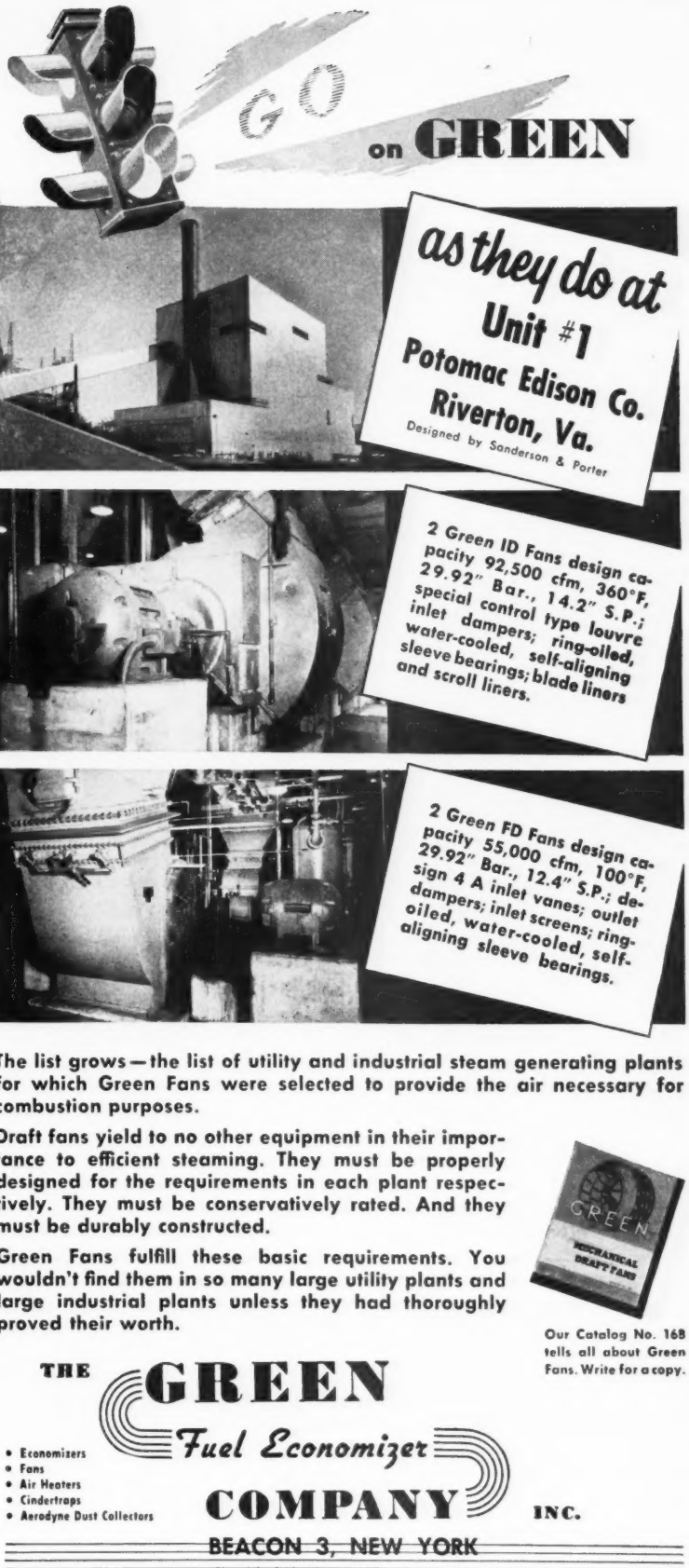
The flangeless screwcover wireways are made of heavy gauge steel, finished in standard gray baked enamel. Other finishes are furnished upon request.

Keystone Manufacturing Co, Center Line, Mich.



Magnetic Starters

Featuring five unit construction and designed to install easier, work better and last longer. The five parts consist


GO on GREEN
as they do at Unit #1
Potomac Edison Co.
Riverton, Va.
Designed by Sanderson & Porter
2 Green ID Fans design capacity 92,500 cfm, 360°F, 29.92" Bar., 14.2" S.P.; special control type louvre inlet dampers; ring-oiled, water-cooled, self-aligning sleeve bearings; blade liners and scroll liners.
2 Green FD Fans design capacity 55,000 cfm, 100°F, 29.92" Bar., 12.4" S.P.; design 4 A inlet vanes; outlet dampers; inlet screens; ring-oiled, water-cooled, self-aligning sleeve bearings.
The list grows—the list of utility and industrial steam generating plants for which Green Fans were selected to provide the air necessary for combustion purposes.
Draft fans yield to no other equipment in their importance to efficient steaming. They must be properly designed for the requirements in each plant respectively. They must be conservatively rated. And they must be durably constructed.
Green Fans fulfill these basic requirements. You wouldn't find them in so many large utility plants and large industrial plants unless they had thoroughly proved their worth.
GREEN MECHANICAL DRAFT FANS
Our Catalog No. 168 tells all about Green Fans. Write for a copy.
THE GREEN Fuel Economizer COMPANY INC.
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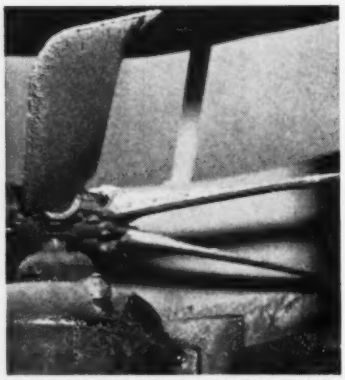
• Fans
• Air Heaters
• Cindertraps
• Aerodyne Dust Collectors
BEACON 3, NEW YORK

DOW CORNING SILICONES

make motors last longer



COURTESY LAKEY FOUNDRY AND MACHINE COMPANY, MUSKEGON, MICHIGAN.

Saves $4500 in rewind costs; outlasts Class A 36 to 1

Engineers at the Lakey Foundry and Machine Company installed a 5-foot induced draft fan at the top of their core oven stack. It exhausted volatiles from the oven so effectively that a resinous deposit built up on the fan blades. This overload, combined with ambient temperatures in the range of 350°F, limited the life of the Class A insulated 7½ hp TEFC motor driving the fan to a month or less.

Life for the motor was further complicated by occasional flash fires that burned off the resinous deposit and melted the aluminum blades. And the cost of getting the motor out of the stack was greater than the rewind costs.

So, the motor was rewound three years ago with Class H insulation made with Dow Corning Silicones. New bearings lubricated with Dow Corning 44 Silicone grease were installed, and the motor was hoisted back into the stack. It has been operating steadily ever since, in spite of all obstacles including 4 stack fires. Savings in rewind costs alone amount to over $4500 at a conservative $125 per failure.

LUBRICATE HIGH TEMPERATURE BEARINGS WITH DOW CORNING 44 GREASE

In open or single shielded bearings designed for high temperature operation, Dow Corning 44 has many times the life expectancy of conventional greases. It gives life-time lubrication in permanently sealed cartridge-type bearings.

That kind of performance in installations all over the country proves that Class H Insulation has 10 to 100 times the life expectancy of the next best class of insulating materials. It can also be used to increase the output of certain motors by as much as 50%.

mail this coupon *Today*

DOW CORNING CORP., Dept. AY-2
Midland, Michigan

Please send me:

- ☐ Performance data on Class H equipment.
- ☐ List of Class H motor repair shops.
- ☐ Data on Silicone Grease for motor bearings.
- ☐ 32-page booklet entitled "What's A Silicone?"

Name_____

Company_____

Street_____

City_____ Zone___ State_____

FIRST IN SILICONES

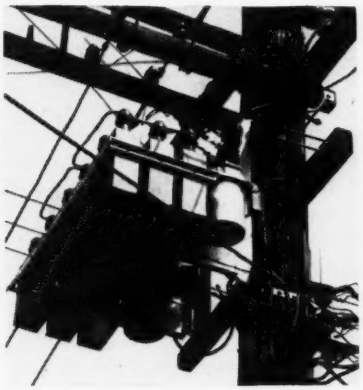
MIDLAND DOW CORNING CORPORATION MICHIGAN

Atlanta • Chicago • Cleveland • Dallas • New York • Los Angeles
Washington, D. C. • In Canada: Fiberglas Canada Ltd., Toronto • In England: Midland Silicones Ltd., London

of two contact blocks, a magnet coil, an armature and a three-coil or two-coil overload relay mounted on a steel panel. Each part can be removed from the front without disturbing another.

It is said that the three-coil, adjustable overload relay permits four ratings from each heater coil by changing its position, providing protection within 3% of full load motor rating. The three-coil overload offers better protection against single phasing when unbalanced or unstable conditions occur.

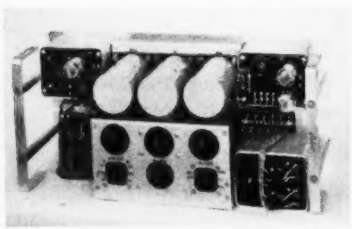
Cutler-Hammer Inc, Milwaukee, Wis.



Capacitor Banks

A compact factory built 12-unit assembly, complete with three single-phase oil switches, ready to mount. Controlling capacitor switching is a plug type control about the size of a watthour meter, which can be pole mounted. Controls can be supplied to operate from either line voltage or current.

Westinghouse Electric Corp, Pittsburgh 30, Pa.



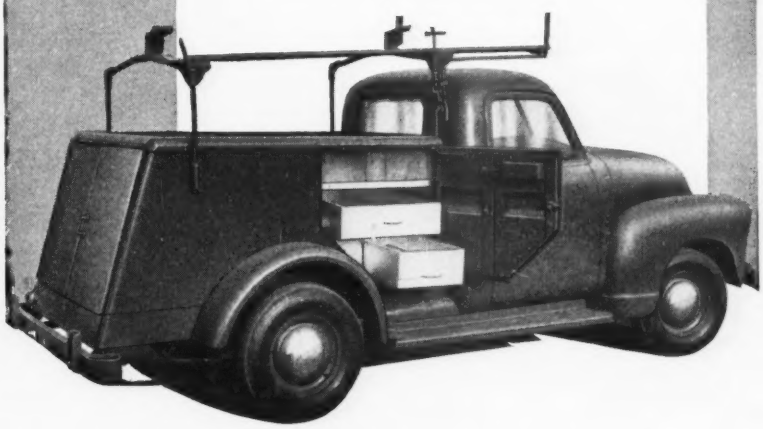
Carrier System

Type 24C, can be used for teleprinter service, remote control and other telegraphic indications. Up to 18 duplex telegraph channels can be derived from a single four-wire circuit.

YORK-HOOVER

MODEL 201U76

new LIGHT DUTY SERVICE INSTALLATION BODY



WHAT THE MODEL 201U76 BODY WILL DO FOR YOU...

Light duty service work must be fast and efficient. Materials and tools must be readily accessible. That is why the new York-Hoover Model 201U76 Body was designed . . . especially for **your** light duty service work . . . for **your** convenience . . . for **quicker, better service.** Efficient design and sturdy construction, combine to provide this **faster, better service** for you . . . at **less** cost.

Write us today regarding your light duty service problems. We will be glad to provide you with all the details, including earliest possible delivery dates of the Model 201U76.

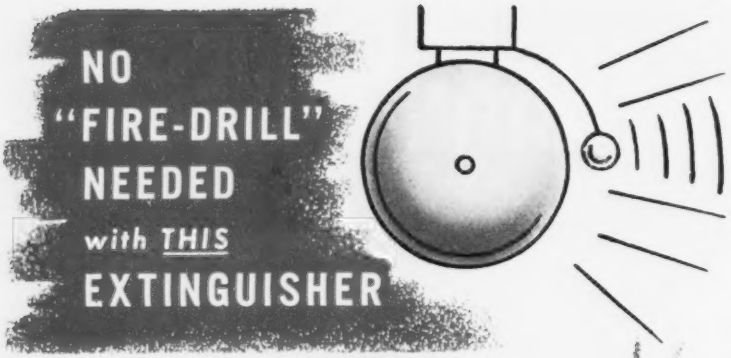
Bulletin No. 930 contains all the facts about our Model 201U76 Body. Write for your copy today!

York-Hoover Corporation

YORK, PENNSYLVANIA

Body Division

NO "FIRE-DRILL" NEEDED with THIS EXTINGUISHER



It's a Randolph!

One glance tells you just how the Randolph operates—no instructions, no explanations necessary! That's why *anybody* can get a Randolph into action fast! No valves to turn, no nozzles to adjust; just point and press your thumb and Randolph's cloud of snowy CO_2 kills fire instantly!

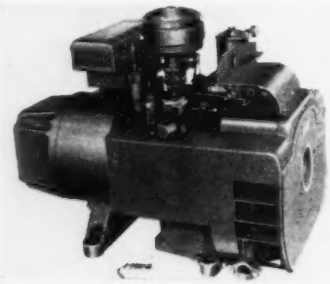
Non-damaging Randolph CO_2 evaporates without a trace, is non-toxic, won't conduct electricity, deteriorate or freeze. And *all* Randolph Models are Underwriters' Approved.

A COMPLETE LINE OF EXTINGUISHERS AND AUTOMATIC SYSTEMS

Learn how Randolph gives your plant panic-proof, split-second protection against flammable liquid, electrical and other hard-to-handle fires! Write Randolph Laboratories, Inc., 4 E. Kinzie St., Chicago 11, Illinois.

Randolph SIMPLIFIED FIRE EQUIPMENT

The system consists of a number of channel terminal panels and common equipment as required. The transmitter, receiver and relays for each channel are included on the basic channel terminal panel, which occupies 8¾-in. of vertical space on one side of a standard 19-in. equipment rack.
Lenkurt Electric Co, Inc, San Carlos, Calif.



Engine-Generator Set

Claimed to have a highly efficient vacuum cooling system employing a centrifugal blower that draws cold air through the generator and over the engine, instead of a water cooled engine. Power units in 5-kw and 10-kw capacitors are available for standby emergency electricity.

The gasoline engine is a twin-cylinder, horizontally-opposed, vacuum air cooled, 4-cycle type with an impulse-coupled magneto ignition system for quick starting with or without batteries. A suppression system that eliminates radio interference is also incorporated on engine, generator and controls.

Advantages claimed are as follows:

1. Low initial cost per kw.
2. Lower operating cost.
3. Increased durability, and reduction in size and weight per kw.
4. Simple to install, maintain and operate.
5. Maximum safety as the unit is enclosed.

D. W. Onan & Sons Inc, Minneapolis, Minn.

Ac Voltammeter

Model 601, features dual, multirange meters for simultaneous current and potential measurements from 0.2 to 500 amp at from 30 to 600v. Accuracy is ±2% of full scale reading; ac frequency range from 25 to 133 cps.

High current ranges of 100, 250 and

500 amp use the external current transformer furnished that plugs into the panel receptacle. Instrument not affected by external ac magnetic fields throughout its range.

A compact 12¼x9x10-in. rugged steel case houses two large, easily read 4-in. meters. The instrument weighs 25 lb.

Associated Research, Chicago 18, Ill.

MORE NEW PRODUCTS

about which you should know

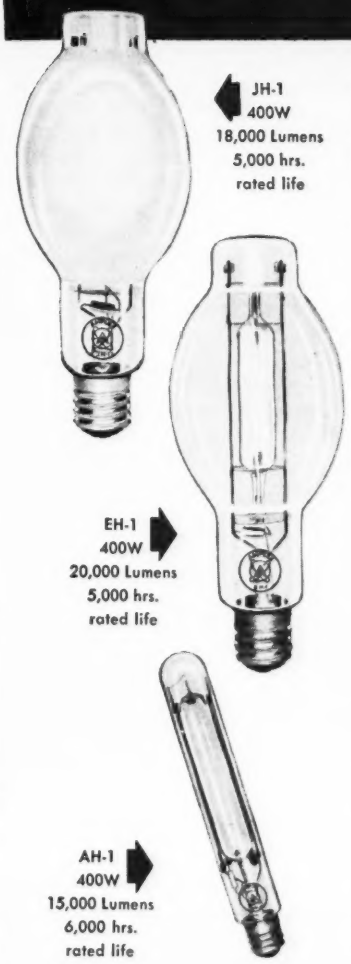
Motorola, Inc, Chicago 51, Ill., has developed a single tone **selective signaling system** for use in conjunction with any communication medium—anywhere that remote control or receiver selection is necessary. There are four basic components to the single tone system: The button selector box, the single tone oscillator, the three frequency switch and the single tone decoder . . . Brown Electro-Measurement Corp, Portland 15, Ore., announces a new panel-mounting series of **decade potentiometers.** Features claimed are linearity better than 0.01%, accuracy better than 0.05%, resolution of 0.002%, response to supersonic frequencies, scale length equaling 100 turn potentiometers and small size.

Aircraft-Marine Products, Inc, Harrisburg, Pa., announces a hand **hydraulic tool** for crimping heavy duty solderless power terminals and connectors to stranded or solid wire in size ranges from No. 8 to No. 4/0. The tool develops 12-tons crimping pressure safely and easily . . . Sunrise Products Co, Hawthorne, N. J., has a glo-point **soldering unit,** model L-72, which instantly heats up to 1,250 F, it is claimed. Adjustable heat control, light weight and no flames are features.

Jayson Associates, Minneapolis, Minn., announces an inexpensive **vacuum switch** that shuts off the power source when liquid supply runs dry. The Vac-on switch has silver contact points set to open when suction is lower than one in. of mercury and will operate motors up to 2-hp ac and ½-hp dc . . . Electric Cord Co, New York 38, N. Y., has a **dc power system** for emergency operation. It consists of an automatic charger and sufficient batteries for ratings from 6 v to 110 v.

STREET LIGHTING GOES MODERN!

WITH AMPLEX MERCURY VAPOR LAMPS



TWICE AS MUCH LIGHT for the same wattage consumed... double the illumination with no boost in the lighting bill. Burning life several times longer than incandescents. That's what municipalities and utilities get with the new Amplex Mercury Vapor Lamps for street lighting... and it adds up to completely new lighting efficiency and extraordinary economies.

Amplex Mercury Vapor Lamps are made in three types, the ever-popular EH-1 and AH-1, and the highly important new JH-1 which is color-corrected by means of a special phosphor coating that produces a warm, neutral light and abolishes all need for color-correcting incandescents. Performance facts of all three lamps are shown under their respective illustrations.

For the full story on Amplex Mercury Vapor Lamps and for detailed information regarding their practical application, write **Amplex Corporation, Department J-2, 111 Water Street, Brooklyn 1, New York.**

AMPLEX

Sealed-Beam Reflector Lamps, Colorbeam Lamps, Spotlites and Floodlites, Industrial Infra-Red Heat Lamps, Vibration and Rough Service Lamps, Street Lighting Lamps, Traffic Signal Lamps, Incandescent Lamps, Fluorescent Tubes, Display Accessories.

LETTERS TO THE EDITOR

Insulators and Cigarettes

To the Editor:

I was puzzled . . . by the advertisement on page 4 of your Dec. 22 issue. This is an advertisement for Lapp Insulator Co showing a 150-kv antenna entrance insulator. May I ask what that package of Chesterfield cigarettes is doing in this picture?

John E. Prejean
Storekeeper
Gulf States Utilities Co
Orange, Texas

• Reader Prejean voices the perplexity of others. To clear the matter we will quote Lapp Insulator Co's reply to our inquiry.

"It is extremely difficult in a photograph of an unfamiliar product to give any impression of size. In this case, from the illustration alone, the bowl could have been any size from 2" or 3" in diameter up to the dimensions of an Eskimo's igloo. In such photographs, it is common practice to insert various "props" to give an automatic indication of size. It may be a hand, a foot rule, a pipe, a lead pencil —any of hundreds of items with which we are all familiar will serve."

Distribution in Chile

To the Editor:

This is in reference to your expressed interest in electrical problems in South America. May I say that it was my privilege and pleasure to live in Chile for three months and observe rather closely the 3-phase, 4-wire, 200/380-v distribution systems used in that country, particularly at the copper smelter and the smelter town. We had no unusual lamp replacements and no accident occurred around the smelter, the power station and boiler plant, or at our home due to operating at 200 v. Range, refrigerator, mixer and short-wave radio were operated from a 200-115/230-v transformer. If some of the predictions as to residential load growth in the United States are true it would seem to me that our present 115-v system will be totally inadequate.

One of the most difficult problems in the desert country with ocean fog coming in was the matter of deposits on insulators and numerous flash-overs resulted. I have sent my Chilean friends quite a lot of information contained in Electrical World and in the AIEE publications dealing with this problem.

One of the difficult problems in South America is the failure of American manufacturers to have their instruction books written in both English and Spanish and the problem of translating technical English into technical Spanish on the run when questions are asked is at least difficult. The best example of how to do it is a catalog of the Johns-Manville Co dealing with power plant mechanical goods. Each page is divided down the center. At the top of the page is an illustration of the article with its name in both English and Spanish. If dimensions can be given they are given in English and metric units. The left hand column is in excellent technical English and the right hand column is in excellent technical Spanish. Considerable confusion results due to the various service factors that are applied when 60-cycle motors are operated at 50 cycles and also at 380 v instead of 440 v. Another source of confusion is a complete lack of understanding of temperature ratings and standards of the AIEE. The Germans who lose no chance, along with the English, to knock American-made equipment, all claim that American motors are not "too hot," and operate at too high a temperature.

John M. Drabelle
Consulting Engineer
Cedar Rapids, Iowa

Contracting Troubles

To the Editor:

Just finished article on electrical contractors selling themselves. Very good, but still nothing is being done to really cure the evil.

The Sample Specs (What The Electrical Contractor Is Up Against) are so true it hurts. I shall pass it around so others may understand why I quit bidding over 10 years ago! Also why the "Generals" seldom call me—I'm sensitive, and can't take the pain!

Just because it is a one man shop, don't condemn it. The top ability in the local has taken out a ticket, and only fails when he starts to employ help. If a jackleg starts out he seldom lasts very long if he doesn't learn fast. His wife will see that he gets back on a payroll again!

The answer to our troubles, both big and little, is the man who stands between us and the customer—the architect. He is untrained from the beginning in the electrical field, and hasn't got time to learn. The general contractor is in the same position. If the electrical trade can deal with the customer direct, the job will be a good one, price to the contrary. We must sell the customer—not the architect or the General.

Here's to the electrical contractor becoming an electrician and taking his place in the world of men.

F. T. Whiting
The Elecon Co
Tucson, Arizona

Largest Remote Control

To the Editor:

I note in the Jan. 5 issue an article on the 33,750-kw hydro plant of the Northern States Power Co in Wisconsin. This article states that this is "believed to be the largest remote-controlled hydroelectric installation in the United States."

In this connection, I might call your attention to our South Holston project, which was written up in the January 1952 issue of Civil Engineering. As stated in this article, the South Holston power plant of 35,000 kw is entirely remotely controlled and is at least somewhat larger than the Holcombe power plant.

Harry Weirsema
Asst to Chief Engineer
Tennessee Valley Authority
Knoxville, Tenn.

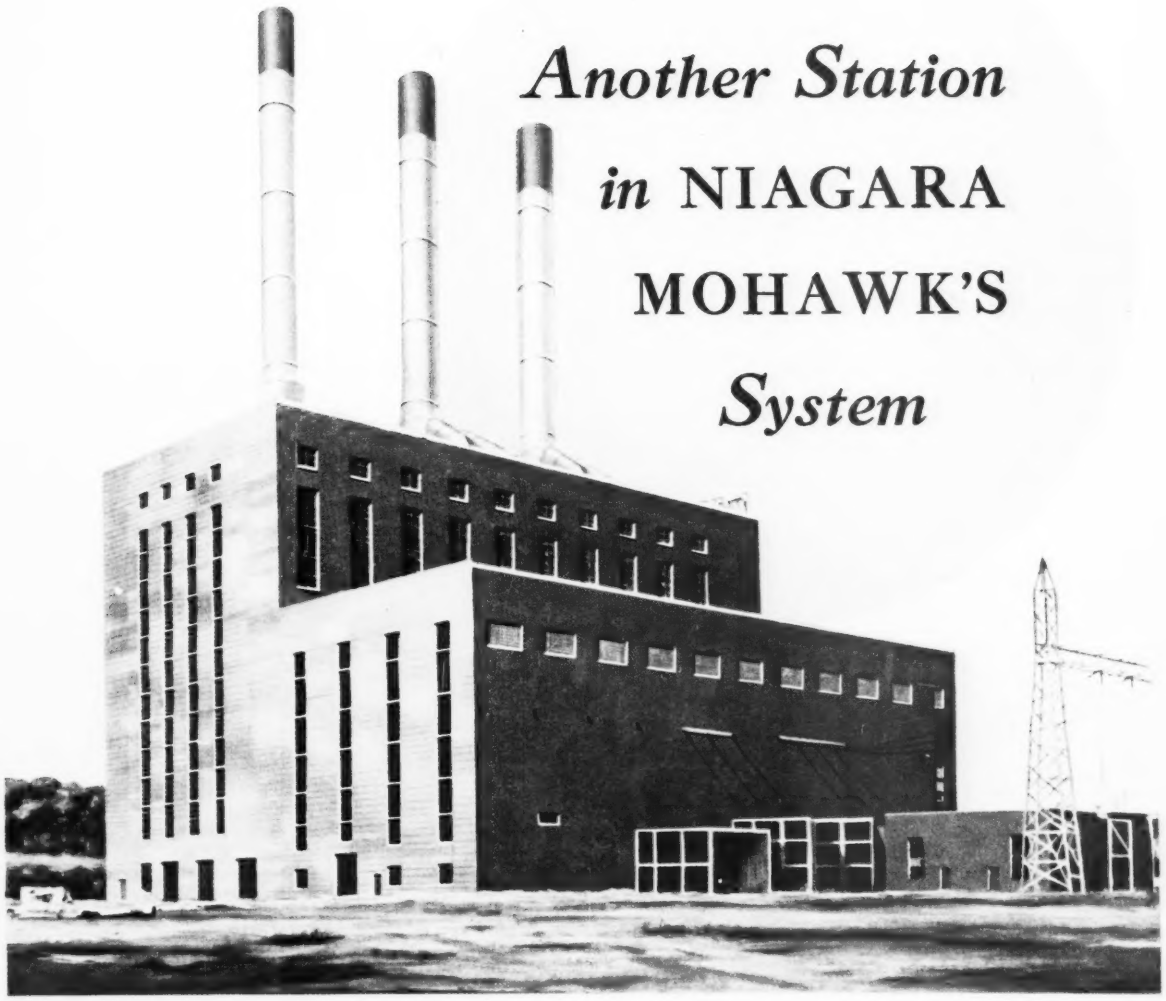
Pumping & Generation

To the Editor:

On page 112 of the Nov. 17 issue, I note that you credit TVA with having the first pump turbine. Some time ago the Connecticut Light & Power Co rearranged the pump connections at Rocky River and have been using the same unit for pumping and for generation.

Clarence W. Mayott
Natural Resources Consultant
Hartford Electric Light Co
Hartford, Conn.

Another Station in NIAGARA MOHAWK'S *System*



ALBANY STEAM STATION
Two units of 100,000 kw each are already in operation, a third is under construction and foundation for a fourth unit is underway

Albany Steam Station, on the west bank of the Hudson River at Albany, New York, serves the eastern part of New York State primarily and is an integral part of the Niagara Mohawk power network.

Designed by the engineering department of Niagara Mohawk Power Corporation with construction supervision by Stone & Webster Engineering Corporation.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.

1 CONDUIT DOES THE WORK OF 2

WITH ROCKBESTOS PNR CONTROL CABLE

Because Rockbestos PNR is approximately ½ the size of competitive control cable, you pull 12 conductor PNR in one conduit where before you had to use two conduits or double diameter conduit to carry the same amount of cable.

Result — one conduit carries almost twice its former electrical load. You save steel conduit and fittings . . . and cut installation costs.

Get the complete PNR story, today. Write or ask your nearest Rockbestos representative.

QUICK FACTS ABOUT PNR

46% smaller area* . . . 28% smaller diameters*. Use smaller conduit and fittings or put more conductors in present conduit.

Dielectric breakdown . . . over 40 times operating voltage.

Lighter and smaller. Easier to handle, store, ship, pull through conduit.

Flexible to — 25°C (–13°F). No cracking!

Rated 600 volts . . . conductor operating temperature 75°C (168°F).

*Average determined by comparison with competitive control cable.

ROCKBESTOS

PRODUCTS CORPORATION
NEW HAVEN 4, CONNECTICUT
NEW YORK • CLEVELAND • DETROIT • CHICAGO
PITTSBURGH • ST. LOUIS • LOS ANGELES
OAKLAND, CALIFORNIA • NEW ORLEANS • SEATTLE

WHAT THEY'RE SAYING

At Industry Meetings

Needed: 33 Million Houses

GENERAL JOHN J. O'BRIEN, president, Gunnison Homes, Inc before 400 dealers at the Second Annual Convention of Gunnison Homes at Chicago, Ill.

During the next twenty five years America will be faced with a need of over 33 million housing units resulting from the tremendous population increase. In 1937 our population was expected to increase to the extent of 900,000 persons per year over the next decade and a half. Today conservative opinions place the average annual population increase at twice that figure. In 1960 the population should reach 175,000,000 people and based on the same rate we should double our population in the next fifty years.

Dual Responsibility Met

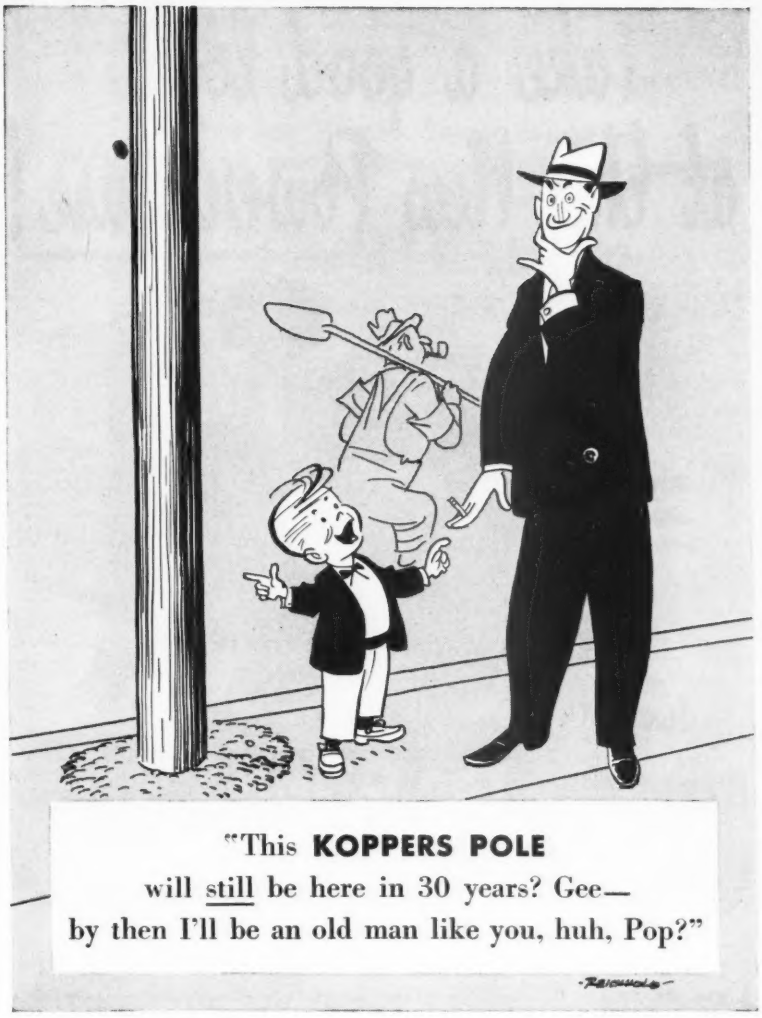
VICTOR MICHER, president, Clarostat Manufacturing Co, Inc.

As manufacturers of radio electronic parts entering military and civilian assemblies alike we must meet the requirements of our armed forces and at the same time not neglect our good way of life. No dual objective is ever simple. There is as great a difference between precision controls and standard types as between chronometers and alarm clocks. It is quite a feat of management to be making both one hundred dollar controls and ten cent controls under the same roof.

1964 Electric Power

A. A. JOHNSON, electric utilities engineering manager, Westinghouse Electric Corp before the AIEE at the Centennial of Engineering at Chicago, Ill.

By 1964 available electric power in the United States will have increased four times over what we had at the beginning of World War II. At that time the U. S. will have an installed electric power generating capacity of 160 million kilowatts compared with today's 80 million. Twenty years from now I believe the figure will go over 250 million kilowatts. With the "hollow coil" cooling technique it will be possible to build tur-



● Sonny doesn't realize it now; but, in all probability, he and this Koppers Pole will *both* be young thirty years hence.

Koppers Pressure-Creosoted Poles are famous for the way they last; for the way they provide long periods of dependable service; for the way they make line operation easier, better, more economical.

Specify Koppers Poles! These strength-retaining poles will cut your maintenance and replacement expenses.

KOPPERS COMPANY, INC. PITTSBURGH 19, PA.

KOPPERS PRESSURE-CREOSOTED WOOD

Take a good look at this New Powerhouse!

The ONAN "CW" Electric Plant

5,000 or 10,000 WATTS

Designed to fit every application better . . . standby, portable, mobile and stationary. *Whatever* your need for electric power, the new Onan CW-5 and 10 give you top performance and value!

Here for the first time are 5 and 10KW electric plants powered by revolutionary, new air-cooled gasoline engines, *designed and built by Onan exclusively for electric plant use!*

Both engines are 1800 R.P.M. The 13HP Onan engine which powers the CW-5 and the 20HP Onan engine used for the CW-10 weigh much less than general-purpose engines, and are amazingly compact. Built to deliver dependable, trouble-free service in heavy-duty use. Two-cylinder, alternate-firing design assures smooth, vibration-free power. New, quiet, highly-efficient vacuum air cooling drives out all heated air through *one* side duct. The same duct carries exhaust gases, simplifying installation.

Impulse-coupled, high-tension magneto ignition for quick starting under all conditions. Both models in all standard voltages 60-cycle A.C., single or three phase.

***Far Out Front* in design and engineering**

● Twin-cylinder, horizontally-opposed, air-cooled, alternate-firing engines ● Aluminum-alloy cylinder heads ● Extra-large, replaceable bearings ● Full-pressure lubrication, 6-quart oil capacity, oil filter ● Impulse-coupled, high-tension magneto ignition, radio suppressed ● Quiet, vacuum air-cooling of generator and engine ● Excellent accessibility; snap-off air housings ● High-performance generators ● Completely equipped with controls and instruments.

Write for folder and specifications

Onan ELECTRIC PLANTS

D. W. ONAN & SONS INC.

5435 UNIVERSITY AVE. S.E., MINNEAPOLIS 14, MINNESOTA

bine generators of 300,000 kilowatts and still not exceed shipping limitations which appear to set the ultimate limit.

Industry's Urgent Need

R. C. SOLLENBERGER, executive vice president Conveyor Equipment Manufacturers Association, before the Truck Trailers Manufacturers Association, at Edgewater Park, Miss.

Systematic cost analysis is one of industry's most urgent needs due to the fact that most companies are just guessing at their handling costs. In many plants processing equipment is in operation less than twenty percent of the time because too much time is wasted in getting materials to it and away from it. Processing time is a minor part of all production but materials handling is a major part and that is where the greatest savings can be made. It is one of the large fields where management still has some control left in its own hands. Better costs analysis is the first step in determining where and how money can be saved.

Television Service's Triple Challenge

J. M. LANG, general manager, General Electric Tube Dept, before the Federation of Radio Servicemen's Association at Harrisburg, Pa.

Developments in ultra-high frequency television, color television and transistors pose a three way challenge to the nation's television service industry. The television serviceman faces a constant battle to keep abreast of a host of new technological developments because this industry of ours is still an infant when we judge it by its potential. I cannot emphasize too strongly the necessity of effective liaison between the service dealer, the distributor and the manufacturer. This will in turn earn the public's good will on which our businesses are based.

It's Up to You

LOUIS KOPINSKI, president, John E. Fast & Co, Chicago executive and operating personnel at a Cost Reduction Training Program in Cleveland, Ohio

All the figures that I have been able to gather indicate that the business outlook is good not just for the next six months but for some time to come. American industry can not and will

not stand still. We know that our economy is settling into a buyers market. That places the ball right in the manufacturers hands, to produce a better product that will appeal to more people at a price that more people can afford.

Brightest Year Ahead

R. E. RITCHIE, president, Arkansas Power and Light Co.

Based on the fact that electric power is a primary index to the economy the forecast for Arkansas is that the state should see its biggest year of new construction and expansion. Our company estimates it will invest nearly $40,000,000 in new power plants during its expansion program in 1953. This is the largest outlay of capital in any one year by AP&L. Statisticians say that for every dollar invested by an electrie utility, other business and industry must spend four to five dollars to use the power. This would put the added Arkansas investment at $200,000,000 in 1953, as the growth related to power expansion. More than one-half of its 1953 investment will be required by new power production. Each of these three new generating units will produce more power than the entire state required prior to 1941.

Air Conditioning for Mass Market

A. E. MELING, residential equipment manager, Carrier Corp before the National Association of Home Builder's Convention at Chicago, Ill.

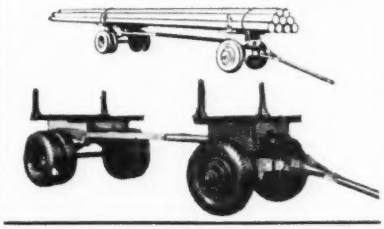
In a small, well-built house you may be able to store cooling equal to half a ton of ice for the next day's use, and in a medium sized house this can amount to approximately the equivalent of a ton of ice in storage effect. With this technical information such as this in selecting equipment being provided all builders, the home owner can reduce the size of equipment required while at the same time providing more even comfort.

There is a great difference that builders should recognize in the installation of air conditioning equipment in residences compared with business structures. Homes receive far less heat from people, in proportion, and this heat load is relatively constant in residences rather than being concentrated into an eight-hour period. Homes have a greater capacity to store cooling in structure and furnishings in relation to the total heat load.

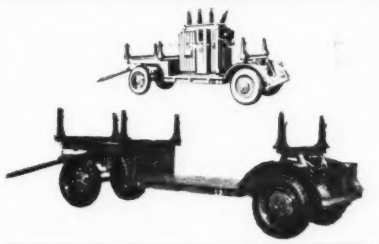
Notes on Eagle Equipment — Designed to save man-hours and money

TRAILERS

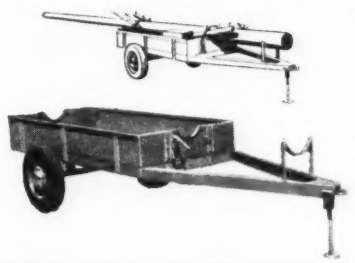
...IN A WIDE RANGE OF SIZES AND TYPES



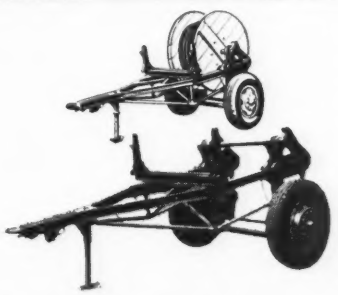
ADJUSTABLE LENGTH POLE TRAILER: easily adjusts to accommodate poles up to 90 ft. long — a big trailer that does a big job. Center pole telescopes. Trails smoothly. Equipped with electric brakes on rear wheels. Get complete information on Eagle Trailer Model 6450.



FOUR-WHEEL LO-BED TRAILER: for easy loading and hauling of heavy bulky units, also suited to pole and general purpose hauling. Five ton capacity, overall length 25 ft. 8 inches. Distance ground to low platform only 25½ inches. Equipped with electric brakes on rear wheels. Get complete information on Eagle Trailer Model 6441.



LIGHT-DUTY CARGO AND GENERAL PURPOSE TRAILER: light-duty, 1-ton capacity trailer for hauling one or two poles, cross-arms, pole hardware, etc. Has pole saddles front and rear and removable end boards. Get complete information on Eagle Trailer Model 7163.



COMBINATION CABLE REEL AND POLE TRAILER: complete with bolsters, stanchions, cable reel saddles. Quickly converted into a pole trailer by removing cable reel saddles and installing bolsters. A practical dual purpose unit, requiring only one trailer license. Get complete information on Eagle Trailer PCP — W-PCP series.

Send today for the complete catalog of Eagle Line Construction and Maintenance Equipment — a useful reference book.

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EQUIPMENT ENGINEERED BY AND FOR UTILITY MEN EXPRESSLY FOR THEIR NEEDS

EAGLE MANUFACTURING CO., Appleton, Wis.

Division of The Four Wheel Drive Auto Co.

Watson Elected Executive VP

Former vice president of Southwestern Public Service also assumes the duties of general manager of the utility

A. R. WATSON

A. R. Watson has been elected executive vice president and general manager of Southwestern Public Service Co, Amarillo, Tex. He has been serving the utility as vice president since 1947.

The post of general manager has been held by J. E. Cunningham, Southwestern PS president, since 1937. Cunningham will continue in the position of president and director of the company.

Joined Predecessor Firm in 1935 . . . Watson has been associated with Southwestern PS and predecessor companies since 1935. He became vice president of Texas-New Mexico Utilities Co at Plainview, Tex., in 1939 and was made president of the company in 1940. He held that office until Texas-New Mexico Utilities became a part of Southwestern Public Service in 1942.

The new executive vice president is a graduate of Rose Polytechnic Institute at Terre Haute, Ind., holding a degree in mechanical engineering. Following his graduation, he joined General Electric Co as test engineer and served the company in both engineering and sales capacities until 1924.

Started Utility Career in 1924 . . . In 1924 Watson started his power company career in the Gulf Coast area. Before joining Texas-New Mexico Utilities, he was employed by Arkansas Utilities Co, holding down the position of vice president and general manager.

Wagner Is Named VP by Wisconsin Electric

Wisconsin Electric Power Co has elected William H. Wagner vice president in charge of sales. The former sales manager replaces Frank A. Coffin who retired recently.

In other appointments, the utility named Almer Skretting general sales manager and James H. Dunham assistant sales manager replacing Skretting.

Wagner joined Wisconsin Electric in 1931 as sales engineer following his

WILLIAM H. WAGNER

graduation from Lehigh University. Four years later he was named industrial sales engineer and in 1947 became assistant sales manager. Wagner was made sales manager in 1948.

An electrical engineering graduate of the University of North Dakota, Skretting has been with Wisconsin Electric since 1922. He became assistant superintendent of industrial sales in 1945 and superintendent of that division in 1948.

Dunham began his affiliation with Wisconsin Electric in 1929 at the Appleton office of Wisconsin Michigan Power Co, a subsidiary. He was transferred to another subsidiary, Wisconsin Gas & Electric Co, at Racine where he became director of promotional activities in 1940. Wisconsin Electric purchased the properties of Wisconsin G&E in 1950 and now operates them as the extension system.

In his capacity of assistant sales manager, Dunham will supervise the merchandising and home service activities of the entire company and will retain his duties in connection with the direction of sales promotion activities in the extension system.

Horton Named President of Coast Counties G&E

J. K. Horton, president of Pacific Public Service Co, has been named president of Coast Counties Gas & Electric Co, San Francisco, a subsidiary firm.

Horton, who has been chairman of the board of Coast Counties G&E, succeeds H. H. Farrar as president of the utility. Farrar resigned the post of president and will devote his time to his duties as vice president of Pacific Public Service.

Horton came to Pacific Public Service in 1944 and served as corporate secretary and legal counsel. In 1951 he was elected executive vice president of Pacific PS and Coast Counties G&E.

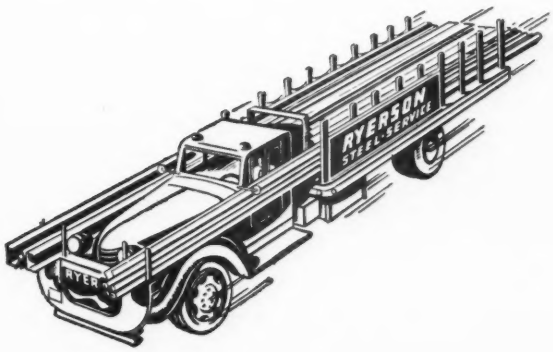
Last year Horton became president of Pacific Public Service and chairman of the board of Coast Counties Gas & Electric.

J. K. HORTON

RYERSON

Ryerson Steel Service awaits your call at fifteen great plants, strategically placed across the nation.

STEEL



Every kind of steel is on hand for quick delivery. Though stocks are currently unbalanced, most requirements are usually available.

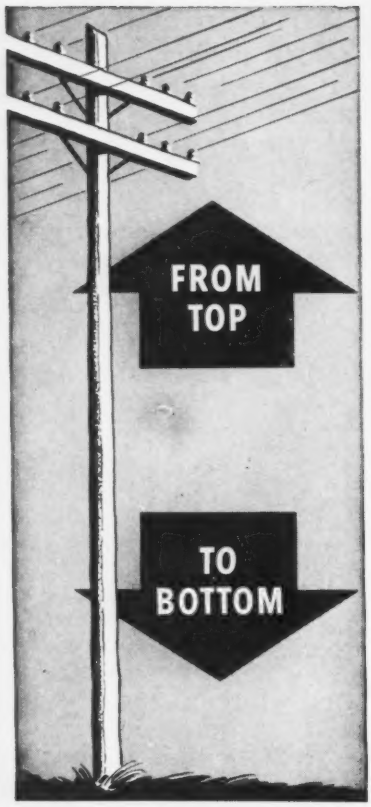
SERVICE

Ryerson representatives are ready to assist you on any problem involving the purchase, fabrication or application of steel.

PRINCIPAL PRODUCTS

CARBON STEEL BARS—Hot rolled and cold finished
STRUCTURALS—Channels, angles, beams, etc.
PLATES—Many types including Inland 4-Way Safety Plate
SHEETS—Hot and cold rolled, many types and coatings
TUBING—Seamless and welded, mechanical and boiler tubes
ALLOYS—Hot rolled, cold finished, heat treated. Also tool steel
STAINLESS—Allegheny bars, plates, sheets, tubes, etc.
BABBITT—Five types, also Ryertex plastic bearings
MACHINERY & TOOLS—For metal fabrication

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CINCINNATI • CLEVELAND • SEATTLE • SPOKANE • DETROIT • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO



Penta gives CLEAN protection

You'll find it's the PENTA-treated poles that last longer, stand stronger, stay *cleaner*. For PENTA is the clean way to safeguard poles, crossarms and other wood construction. PENTA is a chemical formula that's always the same—deep penetrating, powerful, long-lasting. PENTA-treated poles are protected from top rot, shell rot, insect damage, ground-line decay . . . last years longer, cost less to maintain . . . and they're *clean*. Write today for names of companies near you who supply PENTA-treated wood products.

Chapman Chemical Company
Dermon Building, Memphis 3, Tenn.

CHAPMAN®

Penta Preservative

R. R. WISNER

R. R. Wisner Is Appointed Chief Electrical Engineer

R. R. Wisner has been appointed chief electrical engineer of Stone & Webster Engineering Corp, Boston, to succeed Henry B. Wood, who becomes a consulting engineer in the organization. The firm also named L. O. Waite as assistant chief electrical engineer.

After graduating with an electrical engineering degree from the University of Washington in 1912, Wisner became connected with Stone & Webster. He has been identified with utility and industrial projects in Canada, Poland, and the U. S. and special work for the Atomic Energy Commission.

A graduate of the University of Michigan, Waite since 1920 has been in the Stone & Webster engineering department with headquarters at Boston. Wood, who joined the corporation in 1917, has served as chief electrical engineer since 1929.

General Electric Reveals 'Appliance Park' Changes

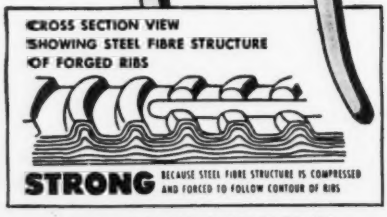
General Electric Co's Major Appliance Division has made the following personnel changes at "Appliance Park," Louisville, Ky.:

Louis H. Miller has been changed from manager of marketing to manager of distribution research; John F. McBride from manager of sales planning to manager of marketing; Paul M. Augenstein from manager of marketing for electric sinks and cabinets to division manager of sales planning; and James H. Goss from division manager of manufacturing to general manager of the home laundry equip-

UTICA'S NEW RIB-JOINT® PLIERS

Full forging of the rib joint is the secret of this new UTICA pliers. Forging makes the steel fibre structure follow the contours of the ribs as shown in the diagram below. Hence, each rib shares the sinew-like strength of the entire joint.

Be sure you see these new pliers! One look, one "heft", and you'll know they are "UTICA® quality."


CROSS SECTION VIEW
SHOWING STEEL FIBRE STRUCTURE
OF FORGED RIBS
STRONG
BECAUSE STEEL FIBRE STRUCTURE IS COMPRESSED AND FORCED TO FOLLOW CONTOUR OF RIBS

IT PAYS TO USE QUALITY TOOLS
and the world's best tools are made in U.S.A.

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In Canada
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ment department succeeding Carl E. Anderson, who is assuming new duties with the Aircraft Gas Turbine Division, Evendale, Ohio.

Motorola Appoints 2 VPs

Motorola, Inc, has announced the election of two vice presidents. Walter Scott, formerly works manager, was named vice president in charge of manufacturing, Consumer Product Division. John Silver, general manager of the Communications and Electronics Division, was made vice president in charge of operations of that division. Scott joined Motorola in 1946. Silver, who was appointed to the general manager's post in 1949, came to Motorola in 1944.

•

W. R. Lockwood has been appointed manager of the Seattle (Wash.) steel service plant of Joseph T. Ryerson & Son, Inc. He succeeds **C. W. Summerville,** who has served as manager since Ryerson acquired the plant in 1951. Summerville, who was a founder of the Seattle facilities acquired by Ryerson, will continue with the firm as advisory consultant to management. Lockwood, a 26-year Ryerson man, has served as assistant manager at Seattle for the past year.

Malcolm M. Moore has been re-elected president of the Pacific County PUD of South Bend, Wash. The Pacific County PUD also appointed Claude Vanderslice as secretary to succeed Claude House, Jr. who has resigned.

OBITUARY

Marion E. Bond, 49, electronics engineer for Motorola, Inc., died Jan. 19 at Elmhurst, Ill. He joined the company in 1939, and had been chief engineer of its communications and electronics division two-way radio service since 1949.

Charles L. White, 83, retired operator of Georgia Power Co's White Water Creek power station, died recently at Montezuma, Ga. He was station operator for more than 25 years.

John T. Hill, 62, who retired last year as division engineer for the Jersey Central Power & Light Co, died at Morristown, N. J., Jan. 23.

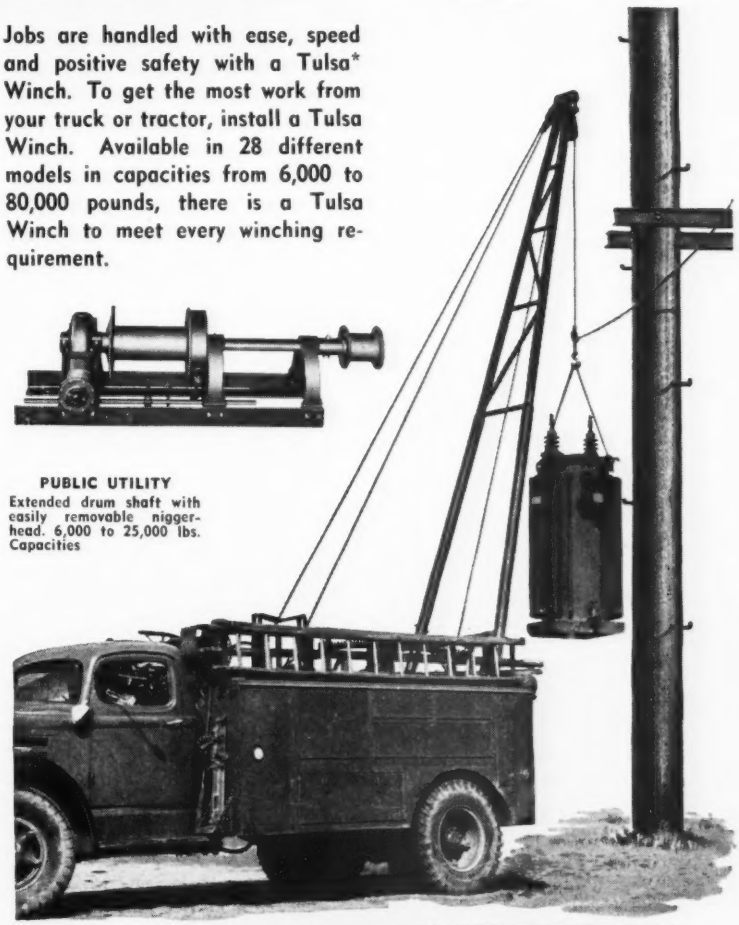
PULL and POWER

Tulsa Winch models for all trucks from ½-ton up.

Tulsa Winches for all crawler tractors complete with transmission, line roller assembly and mounting brackets ready for installation.

Jobs are handled with ease, speed and positive safety with a Tulsa* Winch. To get the most work from your truck or tractor, install a Tulsa Winch. Available in 28 different models in capacities from 6,000 to 80,000 pounds, there is a Tulsa Winch to meet every winching requirement.

PUBLIC UTILITY
Extended drum shaft with easily removable nigger-head. 6,000 to 25,000 lbs. Capacities



*Reg. U. S. Pat. Off.

Tulsa* Winch
TULSA, OKLAHOMA
DIVISION OF VICKERS Inc.

1st Rolling Mill . . .

. . . on Pacific Coast will be constructed by Harvey Machine Co. Plant to cost $20 million

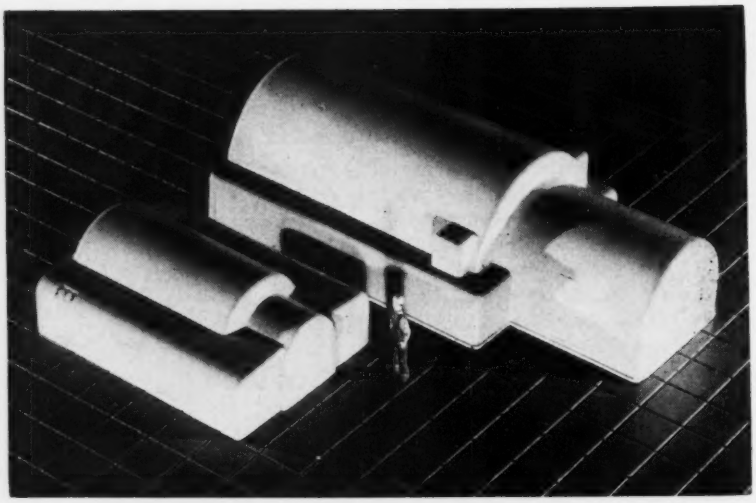
Plans for the construction of the first rolling mill on the Pacific Coast for the production of aluminum sheets, strips, and circular shapes were announced late last month by Harvey Machine Co, Inc, Torrance, Calif.

Erection of a new plant which will cost $20 million will begin as soon as a site is selected, stated Leo M. Harvey, president of the firm.

It is believed that the site will probably be adjacent to Harvey's present Torrance plant.

The new mill is an integral part of the expansion goal set by Defense Production Administration to increase facilities for the production and heat treating of aluminum sheets and strips as a part of the nation's defense program.

The entire project will be built by private financing, Harvey said. Emphasizing the need for such a rolling mill, Harvey pointed out that practically all of the aluminum sheets and strips used by manufacturers of aluminum products in the Pacific area must be shipped from mills located in other areas. This remoteness from sources of supply frequently forces local area manufacturers either to carry substantial inventories of alumimum or, when this is not possible, to incur production delays until the needed material arrives. The new rolling mill will have capacity to supply a large portion of the aluminum sheet and strip needs of the Pacific area.



Supercharged Cooling Cuts Size

Dramatic reduction in size will be achieved in the new supercharged-hydrogen-cooled turbo generator now under construction by Allis-Chalmers Manufacturing Co. Higher operating pressure will increase the cooling capability of the hydrogen. A centrifugal blower on the rotor shaft will drive cooled hydrogen through the rotor hollow conductors, removing the heat where it originates. High-velocity hydrogen also will pass through the stator conductors.

The scale models shown illustrate the effect of this new principal upon the size of a 60,000-kw machine.

First supercharged generator, a forerunner to this new design, has completed a full year of severe utility service. It generated 408,849,000 kwhr with a 97.41% service factor. Shop tests and operating experience on this machine cleared the way for the radical new design.

New Method Determines Transient Voltages

General Electric Co's Power Transformer Department at Pittsfield, Mass., newly developed method of determining transient voltages in transformers by using electromagnetic models.

Size and weight reductions in large high-voltage power transformers are made possible through the model testing methods, according to Lynn Wetherill, manager of engineering of the Power Transformer Department.

"Answers on voltage magnitudes and waveshapes, vital information to transformer designers, are supplied accurately and simply by testing a model before the transformer itself is designed," Wetherill said. This information enables designers to plan the construction of transformers with more efficient use of insulation and consequently more exacting use of materials and space.

The electromagnetic model reproduces the voltage magnitudes and wave shapes between any two points in a transformer, for applied waves of all types, and for all transformer applications.

On eleven models recently built and tested by GE, 238 measurements of the maximum voltages between corresponding points on models and on the actual transformers showed an average deviation equal to only 4.3% of the applied wave and to only 9.8% of the voltage appearing on the transformer.

Models will be built for most GE transformers rated 100,000 kva and above, and all transformers having complicated winding designs.

In the past to determine transient voltages exactly, full-size transformers were tested with a transient analyzer. Changes indicated on a completed transformer were expensive and time-consuming.

Electric Heating System Combines Pumps, Panels

A new development in electric house heating—a combination of room unit heat pumps and radiant glass panels—was disclosed in private showings at the Home Builders' Show held recently in Chicago.

The heat pumps will be installed in the wall structure of rooms where summer cooling is desired. Cooling load determines size of pumps whose heating capacity will reduce number of radiant glass panels that

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DO AWAY WITH GUY GUARD TROUBLES LIKE THIS . . .

SPECIFY *Flexibal*

THE GUARD THAT CAN'T GO WRONG!

COSTS 1/3 LESS THAN METAL GUARDS—AND NO MAINTENANCE PROBLEM

FLEXIBAL Guy Guards — in standard lengths — provide the flexibility that gives with the blow and cushions the impact. Aluminum-painted, they offer both day and night visibility. No other type of guard is so easy to handle, so simple to install — none so effectively cut down losses — never gets out of commission.

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IMMEDIATE DELIVERY

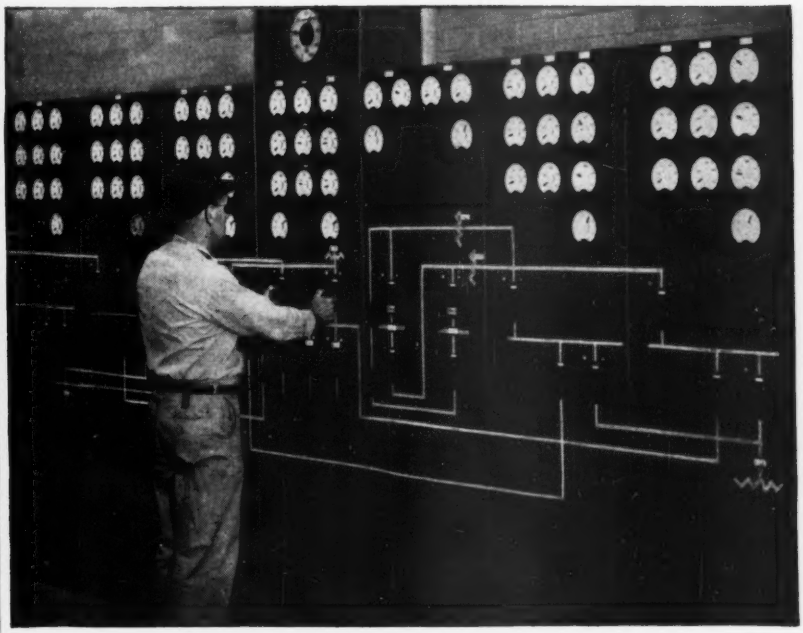
TEN COMPLETE SETS IN THIS ONE LIGHT EASY TO HANDLE CARTON

SEE YOUR JOBBER OR WRITE TO

S. E. OVERTON COMPANY

SOUTH HAVEN, MICHIGAN

Easy-reading K-24 instruments



Give you switchboards that weren't practical before

One man at one of these new switchboards can handle a complete control room or industrial process. It's a marvel of efficiency.

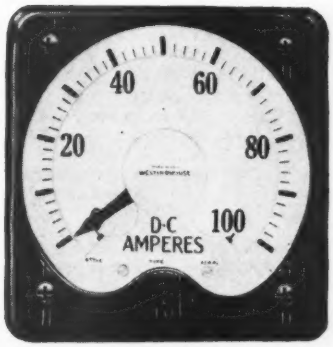
Compactness is what makes these boards efficient. If they were too long and strung out, they would defeat their purpose.

One important factor in keeping these boards compact is the *exceptionally good readability* of the Westinghouse Full-View K-24 instruments. See how this works:

These instruments are readable from wide angles. They can be mounted high on the board—and are fully legible from underneath. Old-style instruments would be mounted lower and strung out horizontally, making for long unwieldy boards.

Another factor: the operator can read Full-View K-24 instruments from much farther away. From one place "he covers more ground". Result: a more compact, easy-to-handle layout.

When you need *any* kind of electrical measuring instruments—call in Westinghouse. And write now for Booklet B-4695, "Getting A Full Measure". Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa. J-40428

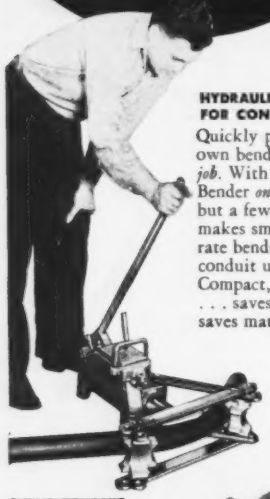


No shadows, no glare, no parallax interfere when you use the Full-View K-24 instruments. The climax of 65 years of intensive study, they are a triumph of optical engineering.

YOU CAN BE SURE...IF IT'S Westinghouse

EVERYTHING YOU NEED IN METERS AND INSTRUMENTS

CUT COSTS WITH GREENLEE TIMESAVING TOOLS FOR ELECTRICIANS



HYDRAULIC BENDERS FOR CONDUIT, PIPE

Quickly produce your own bends *right on the job*. With a GREENLEE Bender *one man* in but a few minutes makes smooth, accurate bends in pipe and conduit up to 5". Compact, portable . . . saves hours, saves materials.

HAND BENDERS FOR TUBING, PIPE, CONDUIT

Quickly form small-radius bends without flattening or kinking. Especially designed to make neat bends for sharp corners, nooks and other close quarters. Saves up to 75% in time and materials on many jobs.

KNOCKOUT PUNCHES AND CUTTERS

For fast, easy enlarging of knockouts and cutting of holes in metal boxes, cabinets, panels. Various sizes and models for making openings for conduit sizes from ½" up to 3½". To operate, simply turn with a wrench.

HYDRAULIC KNOCKOUT PUNCH DRIVER

Portable hydraulic unit for driving GREENLEE Knockout Punches. Speeds jobs . . . easily operated. Develops over 11 tons of pressure so that conduit openings are cut in 10-gauge metal with ease.

CABLE PULLER AND BORING TOOLS

Specifically designed to save time, speed jobs . . . eliminate tedious, heavy work. Companion tools to many other GREENLEE timesavers for the electrician.

GREENLEE

Write for new Electrical Tool Folder, Greenlee Tool Co., 1802 Columbia Ave., Rockford, Ill.

otherwise would be required.

Proponent of the new heating method is Electriglas Corp, Bergenfield, N. J., which has built prototype models and is now exploring the commercial possibilities.

SALES ASSIGNMENTS

COMPANY STAFFS

Copperweld Steel Co's Wire and Cable Division has placed Avon W. Conrad in charge of sales operations in Minnesota, North and South Dakota, upper peninsula of Michigan, and the upper portion of Wisconsin. Conrad, who joined Copperweld in 1940, will make his headquarters in Minneapolis. Copperweld has also assigned Robert E. Winslow to cover the states of Iowa, Nebraska, Wyoming, and Colorado.

Graybar Electric Co. New York, has appointed W. J. Goerisch as Central district sales manager at Chicago. Goerisch, who started with Graybar in 1929, has been general power apparatus sales manager for the company's general department in New York since 1950. L. C. Esthus, district sales manager at Chicago since 1951, has been transferred to Des Moines, Iowa, as manager. D. M. Hitchcock, present Des Moines manager, has been sent to Denver, Colo., to replace S. B. Hardin, who has retired. C. L. Powell has been made manager of the Flint (Mich.) branch and T. E. Mahan has been appointed manager at Columbus (Ohio), succeeding C. E. Furber, deceased.

REPRESENTATIVES

W. C. Dillon & Co, Inc, Van Nuys, Calif., has named Mark Alan & Associates to act as its sales representative in Chicago, where the Dillon firm was formerly located. The representative is located at 176 W. Adams St., Chicago.

Brown Boveri Corp, New York has appointed N. M. Mintz & Associates, 7917 S. Exchange Ave., Chicago, as its sales representative for the metropolitan Chicago area.

MEETINGS CALENDAR

Edison Electric Institute
Transmission-Distribution Committee, Shoreham Hotel, Washington, D. C., Feb. 12–13; Electrical Equipment Committee, Jefferson Hotel, St. Louis, Mo., Feb. 16–17; Industrial Power-Heating Section, Schenley Hotel, Pittsburgh, Feb. 16–17; 19th Annual Sales Conference Edgewater Beach Hotel, Chicago, Mar. 30–April 2; Accident Prevention Committee, Edgewater Beach Hotel, Chicago, May 4–5; Transmission-Distribution Committee, Edgewater Beach Hotel, Chicago, May 5–6; Electrical Equipment Committee, Sir Walter Hotel, Raleigh, N. C., May 11–12; 21st Annual Convention, Atlantic City, N. J., June 1–4.

Pennsylvania Electric Association
Transmission-Distribution Committee, William Penn Hotel, Pittsburgh, Feb. 12–13; Systems Operation Committee, Hotel Brunswick, Lancaster, Pa., Feb. 19–20; Prime Movers Committee, Benjamin Franklin Hotel, Philadelphia, Feb. 26–27.

Canadian Electrical Association
Following Western Zone Division Meetings will be held at Palliser Hotel, Cal-

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a symbol of Wickwire Quality when you're buying wire rope. It's your assurance of utmost stamina and uniformly dependable performance...longer, more economical service on the job.

Write for free copy of "Know Your Ropes"—82 pages of helpful information on selection, application and correct usage of wire rope. Address your request to: Wire Rope Sales Office, Palmer, Mass.

The Colorado Fuel & Iron Corporation, Denver, Colorado
The California Wire Cloth Corporation, Oakland, California
Wickwire Spencer Steel Division, Palmer, Massachusetts

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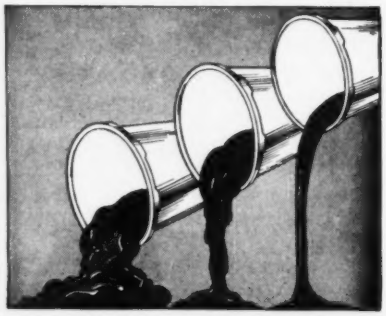
PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL & IRON CORPORATION CF&I

BRANCHES IN ALL KEY CITIES

Insulating and Cable-Pulling
COMPOUNDS
of Record-Breaking Performance



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Send for new literature and prices.

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MINERALLAC

gary, Atla.: Engineering, Feb. 23–25; General Division, Feb. 25–26; Sales Division, Feb. 26–27; Annual Convention, Manoir Richelieu, Murray Bay, Que., June 25–27.

National Adequate Wiring Conference
La Salle Hotel, Chicago, Feb. 26–27.

Southern Safety Conference-Exposition
Hotel Atlanta Biltmore, Atlanta, Ga., March 1–3.

Public Utilities Advertising Association
Region 1, Parker House Hotel, Boston, Mar. 4-5; Region 5, Jefferson Hotel, Richmond, Va., Mar. 12–13; National Convention, Chase Hotel, St. Louis, May 7–8.

Pacific Coast Electrical Association
Engineering-Operating Section Conference, Long Beach, Calif., March 5–6; Administrative Services Section Conference, Phoenix, Ariz., April 8–9; Annual Convention, Hoberg's, Lake County, Calif., May 13–15.

North Central Electric Association
Electrical Industries Meet, Hotel Nicollet, Minneapolis, March 8-11; Accounting Conference, Dyckman Hotel, Minneapolis, Minn., March 23–24; Accident Prevention Committee, Dyckman Hotel, Minneapolis, Minn., April 21; Distribution-Equipment Engineering Meeting, Dyckman Hotel, Minneapolis, Minn., April 22; South Dakota All-Electrical Industry Meeting, Ward Hotel, Aberdeen, S. D., April 24-25.

A&M College of Texas
Conference for Protective Relay Engineers, Dept. of Electrical Engineering, College Station, Tex., March 23–25.

Southeastern Electric Exchange
20th Annual Conference, Boca Raton Hotel, Boca Raton, Fla., March 23–25; Engineering-Operation Section, Edgewater Gulf Hotel, Edgewater Park, Miss., April 16–17; Industrial Power Sales Conference, Fort Sumter Hotel, Charleston, S. C., May 21–22.

*** American Power Conference**
Annual Meeting, Sherman Hotel, Chicago, March 25–27.

Northwest Electric Light & Power Association
Engineering-Operation Section, Multnomah Hotel, Portland, Ore., Apr. 8–10; Business Development Section, Davenport Hotel, Spokane, Wash., May 4–6.

Missouri Valley Electric Association
Engineering Conference, President Hotel, Kansas City, Mo., April 8–10.

Northwest Public Power Association
Engineering-Operation Section, Osbourn Hotel, Eugene, Ore., April 16–17; Annual Convention, Ridpath Hotel, Spokane, Wash., May 6–8; Accounting Section, Monticello Hotel, Longview, Wash., Sept. 17–18.

American Institute of Electrical Engineers
Southern District Meeting, Louisville, Ky., April 22–24; Northeastern District Meeting, Copley Plaza Hotel, Boston, April 29-May 1; Summer General Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 15–19; Pacific General Meeting, Hotel Vancouver, Vancouver, B. C., Sept. 1–4.

Rocky Mountain Electrical League
Annual Spring Conference, Shirley Savoy Hotel, Denver, Colo., April 26–28.

National Association of Electrical Distributors
45th Annual Convention, Conrad Hilton Hotel, Chicago, Week of May 24.

National Association of Purchasing Agents
Public Utility Buyers Group, Mid-Winter Conference, Hotel Roosevelt, New Orleans, March 9–10; Annual Meeting, Statler Hotel, Los Angeles, May 24–27.

National Electrical Manufacturers Association
Winter Meeting, Edgewater Beach Hotel, Chicago, March 9-12; Annual Meeting, Nov. 9–12.

*** Addition this week.**

3E

INDOOR BUS SUPPORTS

prompt shipment
uniform high quality
easily altered or replaced

Fabrication from unit assemblies of components insure early delivery dates and uniform quality.

3E Bus Supports come in a wide range of styles and sizes for bar cable or tube conductors in flat or 1¼" pipe mounts, for voltages up to 23,000 volts.

For full data ask for New Bulletin 226

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TEST SWITCHES

Full range of sizes and types for the best in modern metering practice.

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AIEE Reports

(*Continued from page* 91)

at 90 C or higher results in excessive temperatures. Cycling is minimized if proper starting temperature is selected.

Silver Plate Connects Aluminum Bus . . . Silver-plated joints on aluminum busses have maintained low contact resistance during a six-month cyclic heat run, said T. J. Connor and W. R. Wilson, General Electric. Corrosion has not been troublesome, and the joints have withstood currents heavy enough to sag the bus bars. The plating process is electrolytic and suitable only for shop application.

Aluminum cables can be terminated with serrated, cast-aluminum connectors or with tin-plated, copper alloy connectors. Inhibiting compounds lowered the contact resistance, said H. R. Harrison and R. W. Honebrink also GE, and 680 heat cycles have not caused failure of these joints.

Discussers cited economies possible in using aluminum for busses. L. T. Guess, Alcoa, said 20 million lbs has been used, mostly with inhibiting compound applied before abraiding.

A-C Breaker Clears Potline . . . The best method of dropping potline load in proposed higher capacity ignitron rectifier installations is by a-c circuit breaker operation. This was reported by S. J. Pope, Kaiser Aluminum & Chemical Corp, and J. K. Dillard and C. R. Marcum, both of Westinghouse. Pope stated that in "using this method, no serious transient disturbances were observed in either secondary phase or cathode currents. Tripping the primary power supply removed any tendency to unbalance currents between parallel rectifiers, and the current in the transformer secondary windings was confined to two windings 180 deg out of phase".

Magnetic Amplifiers Measure D-C Amp . . . Magnetic amplifiers having saturable reactors are used to obtain isolation of instrument, protection and control devices from high d-c voltages in d-c conversion stations, as in industrial, mining, and railway applications, according to W. A. Derr and E. J. Cham, Westinghouse. Previously there had been no method of isolating d-c potential circuits. The problem was particularly acute for circuits of 600 v and above. F. B. Glaza, Dow

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Chemical Co, advised that accuracies of 0.01% are required by electrochemists whereas the so-called commercial accuracy may be satisfactory for switchboards.

Urge Grounding of Industrial Equipment

Adequate equipment grounding for industrial plants was urged by L. J. Carpenter, General Electric. He said that 75% of the injuries attributable to inadequate equipment grounding were directly related to relatively small, so-called "harmless" devices and that over 80% of electrical work injuries were related to circuits and equipment of 600v or less. He stressed the need for standardization of 3-pole plugs and receptacles.

C. L. Eichenberg, Bethlehem Steel Co, pointed out the advantages of a grounded neutral on the 6,900-v industrial power system in his company's plant at Bethlehem, Pa. During 1951, after the program was completed, only two ground faults were experienced, resulting in one equipment failure. Before the neutral grounding program was started, 34 ground faults were recorded in one year, with 19 resulting in equipment failures.

Ungrounded Systems Are Dangerous . . . T. J. Brosnan, Niagara Mohawk Power Corp, stated that of 10 fatal pole top accidents since 1930 in the Western Division of his company, nine occurred on ungrounded systems. He said that the mid points of all series street lighting systems should be grounded.

A 2,300-v ungrounded delta distribution system installed in a rolling mill at Hungtington, W. Va., has caused no fatal accidents in 30 years of operation according to J. Steelman Jr, International Nickel Co. However, he said that he would select a 4.16 or 13.8-kv wye (grounded neutral) system if a new mill were being built.

Grounding the metal enclosure of an electrical home appliance may increase the fire hazard, and an electric shock may be caused that otherwise would not happen, commented A. W. Smoot, Underwriters' Laboratories. But grounding is extremely important for TV and radio receivers that have outdoor antennas, also devices that generate high voltage—such as some types of air purifiers. He suggested

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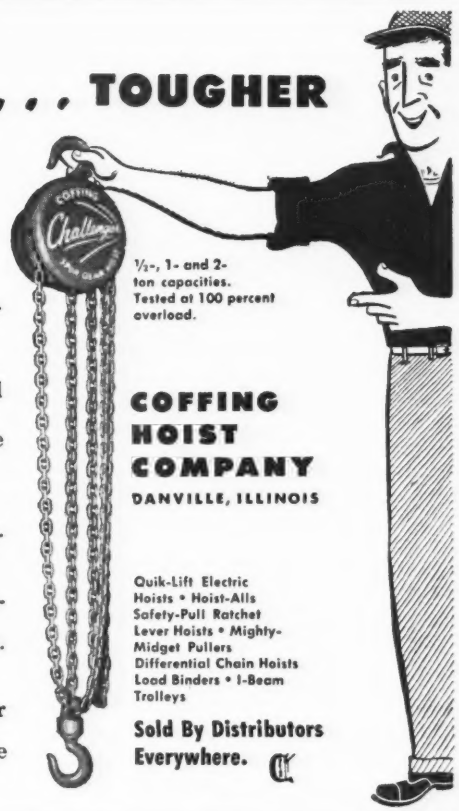

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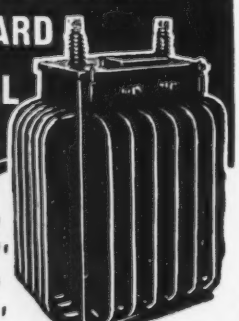

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that one of the line conductors of TV and radio receivers be used for draining electrostatic charges from the antenna circuits.

Propose 240/416-v Distribution . . . The advantages of a 240/416-v, 3-phase, 4-wire, grounded neutral power and lighting distribution system for modern industrial plants were emphasized by D. D. Colker, who presented a paper by William Shuler, Dayton Power & Light Co. He prefers it to the recently advocated 277/480 v system because it (1) permits the use of standard fluorescent lamps, accessories, and 250-v general purpose switches, (2) permits the use of, in 3-phase banks, single-phase transformers having a low voltage winding rated at 240 v, and (3) results in less current in the secondary feeders since the average load of machine tools is far below their rating.

D. S. Brereton, GE, commented that special 3-phase load center transformers would be required for the 240/416-v system—resulting in two standards and higher cost. He contended that a remote control system would also be required for light switching on the 240-v system.

Investment in distribution systems for lighting and power loads can be considerably reduced by installing a combined system in which lights are supplied directly from the 460-v supply. This was supported by economic comparisons of various systems presented by W. H. Kahler, Westinghouse, and R. N. Bell, duPont. With fluorescent lighting, the relative cost of the 460-v, 3-w, combined light and power system was only 62% of separate power and lighting systems, and the copper content was only 34%. In office buildings having a large number of business machines, the economy will not be so great, Kahler said.

Suggests Series Lighting . . . Sam Hibben, Westinghouse, suggested series circuits, using isolating transformers, for industrial plant lighting. He said that the National Electric Code would not be a stumbling block for such systems. C. R. Johnson, Port of N. Y. Authority, called attention to molded all-rubber airport lighting isolating transformers which could be used to advantage in such series systems.

For economical switchgear application and overall system design, for petroleum refineries, generating capacity should not exceed 10,000 to

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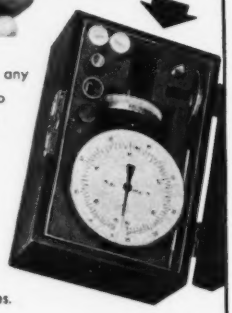

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15,000 kva at 2,400 v, in the opinion of R. F. Lawrence and H. B. Thacker, Westinghouse. The most applicable basic system arrangements are (1) loop primary radial; (2) banked secondary radial; and (3) primary selective radial, they said.

Mercury Lamp Gives White Light . . . Virtues of the white mercury lamp—"the most economical and convenient source for mass white light in the history of artificial illumination"—were enlarged upon by Eugene W. Beggs, Westinghouse. The lamp has all of the economy and efficiency characteristics of standard mercury lighting while substituting a white light for the blue-green hues of mercury. This makes it useful almost universally, including places where color appearance is important.

Newest version of the color-corrected mercury lamp is a 1,000-w light that produces 50,000 lumens, as against the 21,800 lumens produced by a 1,000-w incandescent. The lamp is actually a two-in-one job. It consists of an inner tube of quartz in which the mercury arc produces not only blue-green tones but ultraviolet rays as well. This inner tube is enclosed in a larger glass envelope lined with fluorescent material or phosphor. Ultraviolet rays cause the phosphor to fluoresce red, thus supplying the color missing in standard low cost mercury lighting and resulting in new low-cost white light mercury.

Electric House Heating Will Come . . . Electric house heating is a coming thing, and utilities had better get ready to handle the load. This was the area of agreement for the three conference papers presented at the session on electric space heating.

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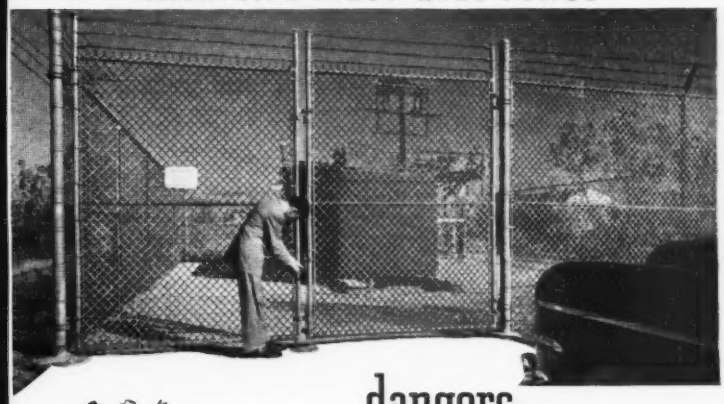

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3	37½	G. E.	6900—230/460
2	100	G. E.	4800/2400—480/240
2	250	West.	2300—460
3	150	West.	2400—230/115
1	100	G. E.	2300—575, 3 ph.
6	50	West.	2400—114/228, DRY TYPE

INDUCT. REGULATORS—OUTDOOR

1—140 KVA G. E. 200 A. 4000 V. 3 ph.
4— 60 KVA West. 250/500 A. 2400 V. 1 ph.
6— 48 KVA G. E. 200 A. 2400 V. 1 ph.
8— 36 KVA West. 150/300 A. 2400 V. 1 ph.
2— 36 KVA G. E. 75/150 A. 4800 V. 1 ph.

CIRCUIT BREAKERS

1— 400 A. 37 KV G. E. FHKO-236-500 MVA
1—1200 A. 15 KV G. E. FKO-139-350 MVA
4— 600 A. 15 KV G. E. FHKO-139-750 MVA
1— 600 A. 15 KV G. E. FHKO-136-250 MVA

BREW, WOLTMAN & CO., INC.
52 Church St. New York 7, N. Y.

FROM AVAILABLE STOCK

TURBO GENERATORS IN STOCK

Qu.	KW	Make	Resc.
1—	1000	G.E.	Non-Cond—190 lbs—2400-3-60
1—	1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—Surface Cond.
1—	750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1—	500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Conn. Exciter
1—	400	Westgh.	Non-Cond—125/150 lbs., 5/10 lbs. B.P., 240/480-3-60
1—	300	G.E	Non-Cond 150/175 lbs., 5/10 lbs. B.P., 480-3-60

FREQUENCY CHANGERS

KVA	Make	RPM	Voltages	Frequency
1—3750	G.E.	300	2400/4150-2400/4150	25/60/25
1—3125	G.E.	300	2400/4150-2400/4150	25/60/25
2—2500	G.E.	750	2400/4150-2400/4150	25/62½/60/24

MOTOR GENERATOR SETS
3 ph. 60 cy.

Qu	KW	Make	Speed	DC Volts	AC Volts
1—	2000	G.E.	514	600	6600/13200
2—	2000	G.E.	500	666 25 cy.	11000
1—	1500	G.E.	720	600	13200
1—	1500	G.E.	360	275	2200/4400
3—	1500	G.E.	514	250	6600/13200
3—	1500	G.E.	600	600	2300/4150
1—	1000	G.E.	900	260	4100/6900
2—	1000	Whse.	900	600	2300/4158
1—	500	Whse.	900	250	6809/13200
1—	500	Whse.	1200	125/250	2300
1—	500	Whse.	900	250	440
1—	500	G.E.	720	125	2300
1—	400	G.E.	720	250	440/2300
1—	350	G.E.	900	125	4150
1—	150	G.E.	1200	275	2300
1—	150	Whse.	1200	275	2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
3—1250	G.E.	HVDDJ		6600x550
1—1150	A.C.	OISC		13200x480/2400
3—1000	G.E.	HVDDJ	1	2200x480
5— 300	G.E.	HT	3	2400x240/480

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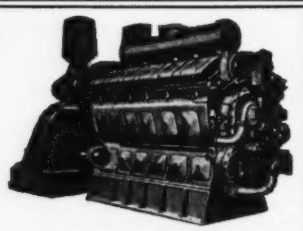
A.C.—50 AND 60 CYCLES
• ALSO D.C. UNITS



A PARTIAL LISTING OF OUR INVENTORY

KW	Make	Model	HP	RPM	KW	Make	Model	HP	RPM
1980	Nordberg	TS-217	2800	225	320	Enterprise	DSG-6	560	450
1500	Fairbanks Morse	33E16	2000	300	300	General Motors	8-268A	450	1200
1136	Fairbanks Morse	38D	1600	720	250	Fairbanks Morse	37-E	375	360
1100	General Motors	16-278A	1600	720	200	General Motors	8-268A	350	900
750	General Motors	12-567	1080	720	150	Worthington	CC-4	225	450
500	Baldwin	VO-8	750	514	150	Buckeye	80	240	600
500	General Motors	8-278A	750	720	100	Worthington	BB-5	150	600
500	General Motors	8-567	720	720	100	General Motors	3-268A	150	1200
400	Ingersoll-Rand	8-8	600	720	60	General Motors	6-71	90	1200
350	Baldwin	VO-6	510	450	30	Internat'l Harvester	UD-14	45	1200

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TRANSFORMERS

1—1500 KVA G.E., 3 Ph., 4150V. 2300V Pyranol
2— 750 KVA G.E., 3 Ph., 4150V. 120/240V. sec.
2— 400 KVA Pitts., 1 Ph., 2400/4800V. 240/480V.
3— 333 KVA Whse., 1 Ph., 2400V. 600 V sec.
2— 200 KVA G.E., 3 Ph., 4150V. 120/240V. sec.
1— 200 KVA G.E., 3 Ph., 2400-220 Sec.
3— 100 KVA Whse. 1 Ph., 13,200V—220/440.

SYNCHRONOUS MOTORS

1— 300 H.P., Elec. Mach., 720 RPM, 3 Phase 60 cyc., 2200V T E F Cooled Outdoor service.
1— 150 H.P., G. E., 1800 RPM, 220V, 3/60
2— 150 H.P., Al. Chal. 360 RPM, 440V. 3/60

MOTOR GENERATOR SETS

1—1000 KW Whse., 600 V 720 RPM, 4000 Syn.
1—1000 KW G.E., 600 V. 514 RPM, 4000V Syn.
1— 200 KW Whse., 275V. 900 R.P.M., 220 V Syn.
1— 176 KVA West., 1Ph., 220V, Motor 3Ph., 400V.
1— 150 KW G.E., 126/250V, 1200 RPM, 2300 Syn.
1— 100 KW G.E., 250V. 900 RPM, 2300V. Syn.

SLIP RING MOTORS

1— 400 H.P. West. CW. 450 RPM 550V.
1— 250 H.P., West., CW, 600 RPM, 440V.
1— 200 H.P., West., CW, 600 RPM, 440V.
3— 150 H.P., Al. Ch. 1800 RPM, 2300V., 3Ph. 60 Cy.
1— 100 H.P. G.E., MT 600 RPM 440V.

Large Stock of A.C. and D.C. Equipment

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Available Immediately
7500 KW G.E. Co.
180 P.S.I.—525°F Total Temp.
3 phase 60 cycle 2300 volt
With Surface Condenser
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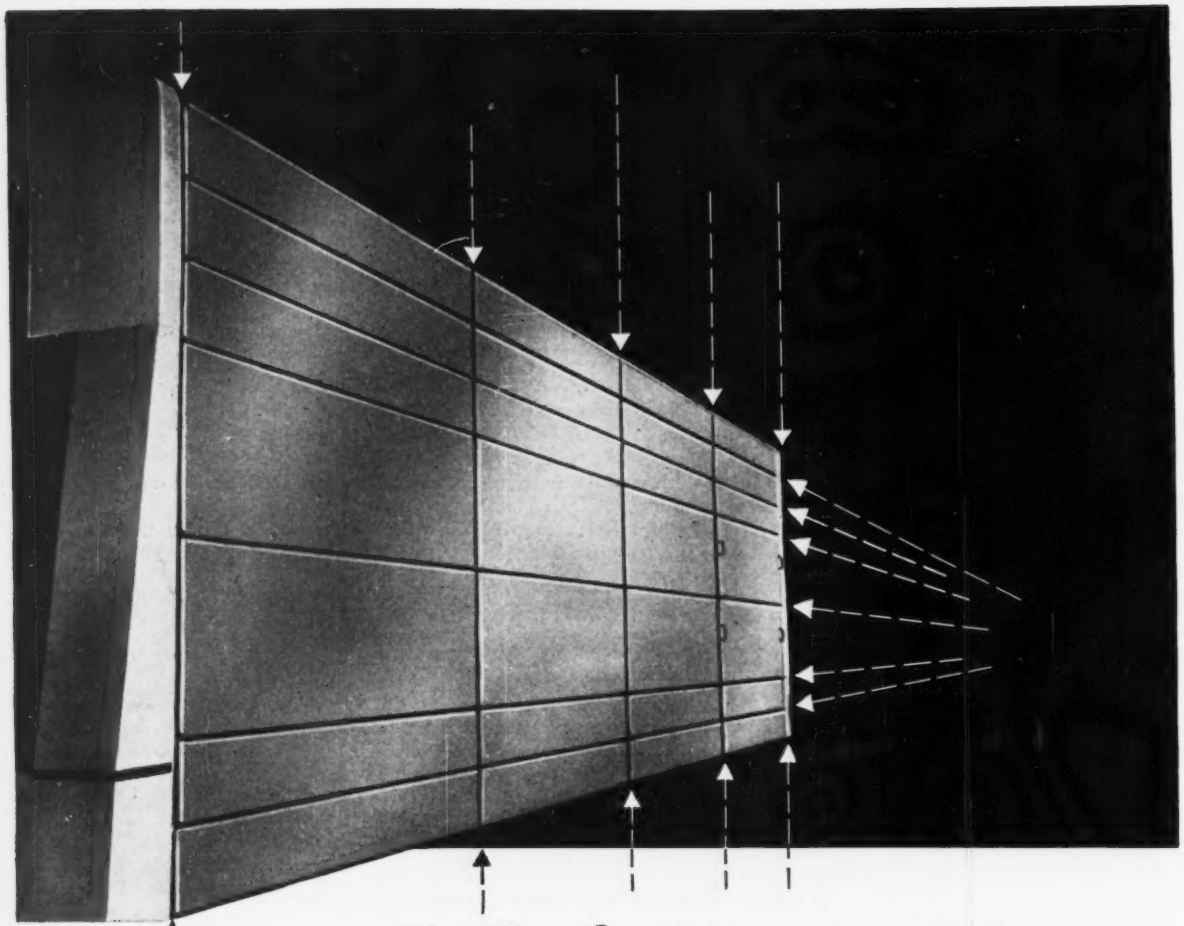

K & M asbestos woven tape

keeps heat in, tightly sealing the joints of this new, prefabricated oven to insure its flexible adaptability

The Advanced Heating Division of Jensen Specialties, Inc., Detroit, Michigan, is producing a new type of prefabricated electric oven for accelerating heating schedules on industrial processing applications up to 700°F. Radiant Calrods in panel type construction accomplish this when assembled on standardized demountable frames. By varying the number of panels and their arrangement, ovens of any size, shape and heat capacity can be field assembled at will. They may also be converted from one application to another without cutting or otherwise damaging the component parts.

The problem of tight thermal construction in this "portable" oven is efficiently solved by the use of K & M Asbestos Woven Tape to seal the joints. Fireproof, tough, uniform, and flexible, this tape can be quickly, easily, and economically applied in any assembly or adaptation of the oven.

K & M Asbestos Woven Tape, specifically designed for the insulation of wires, coils, and cables in the electrical industry, fits the above role well, as it does many others, including the insulation of hot pipes and bends, especially of small diameter. For electrical purposes, it fully meets, in thicknesses from .015" to .030", the A.S.T.M. specifications. It is supplied in the ferrous type for higher temperatures and in the nonferrous type where voltages as well as temperatures are extremely high.

Other Keasbey & Mattison products rendering outstanding service to the electrical, as well as other, industries are Braided Asbestos Tubing, Twisted Asbestos Cord, Asbestos Yarn, Asbestos Thread, and Asbestos Cloth. For information about any of these versatile products—and name of your nearest K & M distributor—write us.

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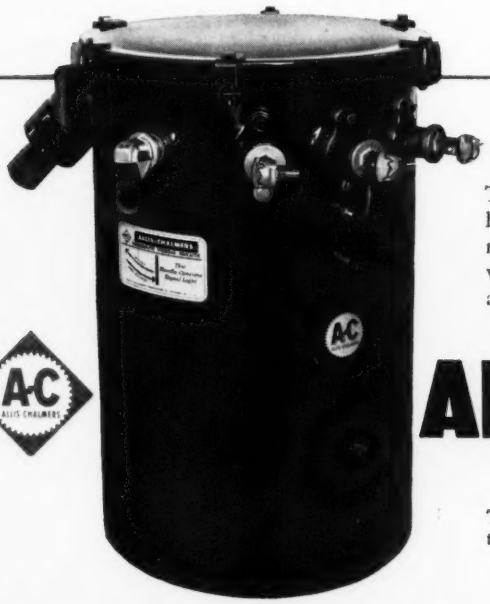
Spots overloads quickly . . . But it won't interrupt service

Here's real ease in overload detection. Check the brilliant light of the *Thermalite* overload indicator right from your service truck. It's visible from hundreds of feet away to keep you posted on load conditions in hard-to-get-at locations.

The *Thermalite* overload indicator shows you when your transformer is overloaded, but it won't interrupt service. That means you can schedule transformer replacements or load rearrangements during daylight hours . . . and do away with costly emergency measures.

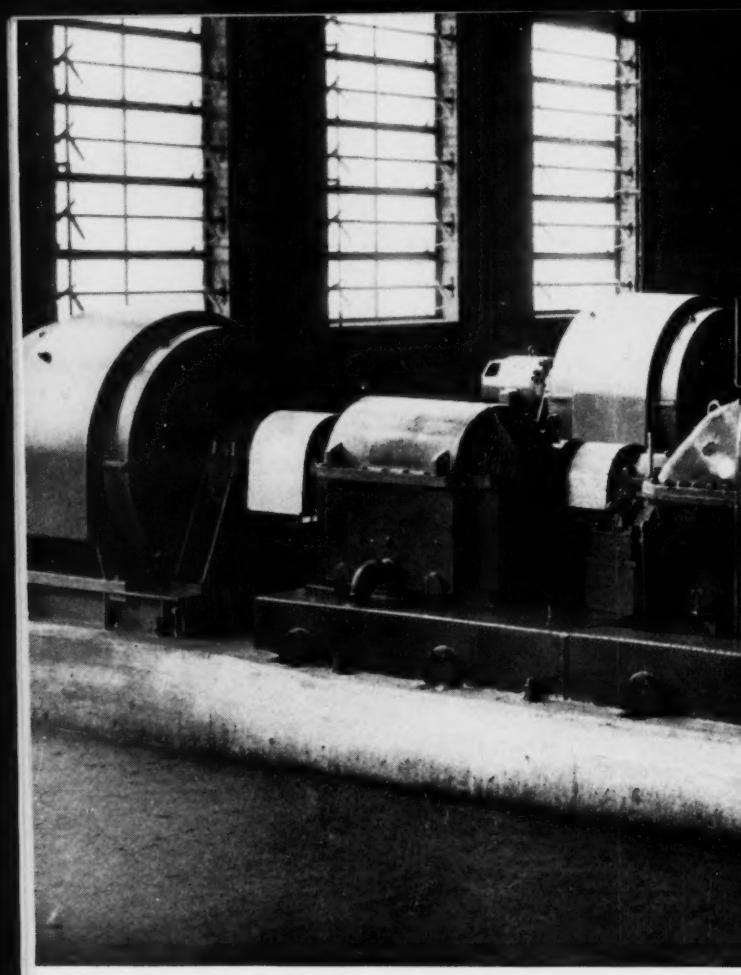


The *Thermalite* overload indicator will save you hundreds of hours of expensive surveys. It eliminates the need for keeping countless records, too. It will pay for itself quickly in transformer utilization and longer transformer life expectancy. A-3843

Thermalite is an Allis-Chalmers trademark.

ALLIS-CHALMERS

The *Thermalite* indicator is available on distribution transformers 100 kva and smaller, 15 kv and below.



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• When the two turbines shown above were installed in a large Milwaukee tannery, they were filled with NONPAREIL Turbine Oil. NONPAREIL lubricates each turbine and its reduction gear unit from one oil reservoir.

During nearly two years' operation, the original fills of NONPAREIL were not removed from the turbines either to clean the oil systems or to treat the oil. Neutralization numbers stayed below 0.04 mg. KOH/gm. Recently, plant officials and a representative of the turbine manufacturer made a thorough inspection of the turbines' lubricating systems. They found gears and bearings in excellent condition. Th
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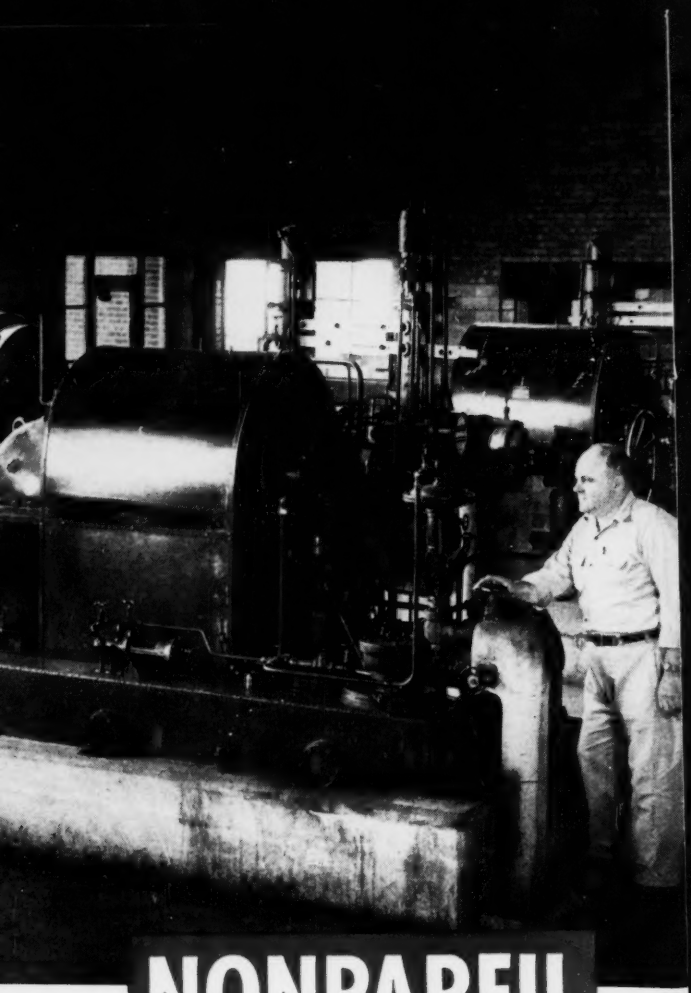

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